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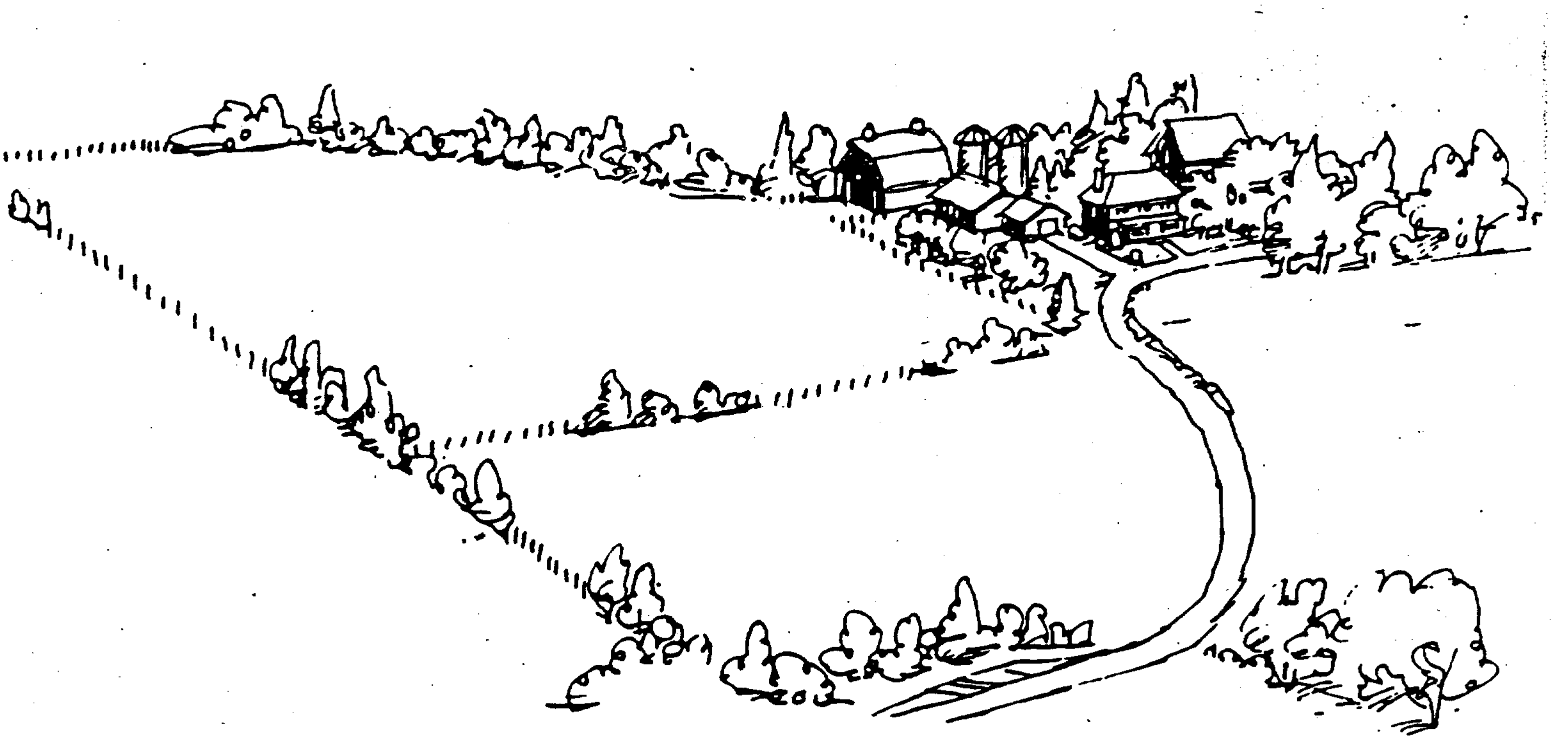
The Agricultural Sector Study

Impacts of Environmental Regulations on Agriculture



THE AGRICULTURE SECTOR STUDY:

IMPACTS OF ENVIRONMENTAL REGULATIONS ON AGRICULTURE

by

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Agricultural Sector Study

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APPENDICES

ACKNOWLEDGEMENTS

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EXECUTIVE SUMMARY

Environmental regulations affect U.S. farms in many ways. Traditionally, the most important of these regulations have been those that restrict, and in some cases prohibit, the use of certain pesticides. Pesticides will continue to be the subject of the most important environmental regulations for agriculture, not only of the traditional registration and use regulations, but also of new regulations requiring health and safety precautions for farmworkers using pesticides, controls on the use of pesticides in areas with vulnerable groundwater or near targeted estuaries, and restrictions on the use of pesticides that threaten endangered species. In addition, other proposed and forthcoming environmental programs affect agriculture. These include the banning of lead in the gasoline used in farm vehicles, the control of stormwater and other runoff from agricultural lands, restrictions on agricultural burning, standards for the operation and repair of underground storage tanks containing petroleum and chemicals, and the reporting of toxic chemical use.

This study examined the cumulative impact of recent and proposed future environmental regulations on the financial condition of farms in the United States. The regulations included in the analysis are those that have been undertaken since 1982 or are anticipated to occur by 1992, and have a direct impact on agriculture. The primary goal of the study is not to determine the aggregate total cost of EPA actions on agriculture, but to examine the impact of these actions on the profitability of U.S. farms and their ability to survive. Because of the complexity of the agricultural sector and the many uncertainties that still accompany the new environmental programs this study has had to limit its focus to a few "representative" farm types and has had to make many assumptions about future environmental requirements. Accordingly, the study cannot be considered to cover all potential agricultural impacts or to present the final word on future environmental programs. It does, however, describe the kinds of impacts that may occur and estimates the range of potential impacts upon a group of farms that are likely to experience relatively large environmental costs.

For livestock-and major field crops, three specific farm types were examined: (1) an Illinois corn soybean farm, (2) a Mississippi cotton soybean farm, and (3) a Kansas cattle wheat farm. For specialty crops, six crops were selected; apples, tomatoes, potatoes, peas, caneberries (e.g., raspberries, blackberries, etc.), and peanuts. There proved to be insufficient information to complete the analysis for caneberries and peanuts, however, so that results are available only for apples, tomatoes, peas, and potatoes. The difficulty in obtaining information about producers of specialty crops was itself a significant finding of the study.

Three regulatory scenarios of future EPA actions. were considered in the agriculture sector study, ranging from a conservative (low cost) scenario to an expansive (high cost) scenario. In addition, two alternative levels of effects were considered for each of the farms that were examined. In an average impact case it was assumed that the farm would incur the average environmental costs of all farms of that type and in a maximum impact case it was assumed that the farm would incur all of the environmental costs that a farm of that type might face. The maximum impact cases represent very unlikely worst cases, but provide an upper bound on the potential losses under each regulatory scenario.

For the three types of major field crops and livestock farms examined in this study, the effects of EPA actions on farms in different financial conditions were considered. The loss in income incurred by farms in average financial condition under the average impact case (average environmental costs) was 3 percent or less under each of the regulatory scenarios considered. Losses of this magnitude resulted in only very small changes in these farms' debt to asset ratios (less than 1 percent). Under the unlikely maximum impact cases, farms in average financial condition experienced substantial losses in income, but were not forced out of business as a result of EPA actions.

The major field crop and livestock farms in vulnerable condition were more sensitive to increased environmental costs than their counterparts in average financial condition. Although the absolute reduction in income was similar for farms in vulnerable and average financial condition under each scenario, these losses resulted in much larger changes in the vulnerable farms' debt to asset ratios. Even though the vulnerable farms' financial conditions were found to deteriorate more than the farms in average financial condition, only one of the vulnerable farms was predicted to go out of business during the forecast period (1987-1996). The Kansas wheat cattle farm in vulnerable financial condition was predicted to go out of business even without any environmental costs and was predicted to go out of business one year earlier than it otherwise would have under one of the regulatory scenarios considered.

Because of limited data availability, the study did not forecast losses in income or changes in debt to asset ratios for specialty crop farms. Instead, it examined changes in net returns per acre (which reflect returns to land and farmer provided labor). Under the least costly regulatory scenario, the changes were generally less than 1 percent for farms experiencing average environmental costs and less than 8 percent for even the maximally affected farm. Under the most costly regulatory scenario, however, losses of the average impacted producers increased substantially, particularly for apple producers in New York and Michigan, where predicted losses were 60 percent and 84 percent respectively. These dramatic decreases in net returns may bring about substantial structural changes in the production and market for the crops affected. Large differences in the impact of EPA regulations on crops grown in different regions occurred because some of the proposed restrictions involve pesticides that are used in some regions and not in others. Even though the results of this study must be considered preliminary, these figures show that EPA actions could create economic problems for some specialty crop farms and suggest that the Agency exercise caution in this area.

The agriculture sector study illustrates the advantages of examining the impacts of environmental regulations at the farm level as well as at the aggregate national level. While national analyses provide useful information concerning the total losses incurred by different aggregate types of farmers (e.g., corn farmers as a whole), the impact of environmental regulations on farms' financial conditions depends on the distribution of those losses among farmers and on the initial financial conditions of the affected farms. In order to determine the effect of EPA regulations on the ability of farms to survive, both aggregate and farm level analyses are necessary.

This study highlights the data and analytical requirements necessary to determine the impacts of EPA actions on agriculture. Such requirements include accurate pesticide usage and efficacy data, improved national commodity price-quantity models, and better information on the financial and production conditions of farmers. Limitations in data modeling capability are currently much more severe for specialty crops than for livestock and major field crops and EPA is seeking improvements in this area. The importance of improving data and modeling. capabilities is likely to increase in the future as EPA tries to cost-effectively reduce environmental risks associated with agriculture.

AGRICULTURAL SECTOR STUDY

Environmental regulations affect farms in the United States in many ways. Traditionally, the most important of these regulations have been those that restrict, and in some cases prohibit, the use of certain pesticides. Pesticides will continue to be the subject of the most important environmental regulations for agriculture, not only of the traditional registration and use regulations, but also of new regulations requiring health and safety precautions for farm workers using pesticides, controls on the use of pesticides in areas with vulnerable groundwater or near targeted estuaries, and restrictions on the use of pesticides that threaten endangered species. In addition, other proposed and forthcoming environmental programs affect agriculture. These include the banning of lead in the gasoline used in farm vehicles, the control of storm water and other runoff from agricultural lands, restrictions on agricultural burning, standards for the operation and repair of underground storage tanks containing petroleum and chemicals, and the reporting of toxic chemical use.

This study examined the cumulative impact of recent and proposed future environmental regulations, on the financial condition of farms in the United States. The regulations included in the analysis are those that have been undertaken. since 1982 or are anticipated to occur by 1992, and have a direct impact on agriculture. The primary goal of the study is not to determine the aggregate total cost of U.S. Environmental Protection Agency's (EPA) actions on agriculture, but to examine the impact of these actions on the profitability of U.S. farms and their ability to survive. Because of the complexity of the agricultural sector and the many uncertainties that still accompany the new environmental programs, this study has had to limit its focus to a few "representative" farm types and has had to make many assumptions about future environmental requirements and other factors that may affect the financial conditions of farms, such as farm support programs under the Food Security Act. Accordingly, the study cannot be considered to cover all potential agricultural impacts or to present the final word on future environmental programs. It does, however, describe the kinds of impacts that may occur and estimates the range of potential effects upon a group of farms that are likely to experience relatively large environmental costs.

AGRICULTURE AND ENVIRONMENTAL REGULATIONS

There are a number of environmental and health hazards that may be associated with agricultural production. These include:

1. Surface Water Pollution
   Water running off farm lands may carry soil particles, pesticides, and animal wastes into the surface waters.

2. Groundwater Pollution
Pesticides and sewage sludge applied to fields and crops, as well as petroleum and chemicals from leaking underground storage tanks, may seep into the groundwater.

3. Air Pollution
Air pollution problems may result from agricultural burning practices and from the use of leaded gasoline powered trucks, tractors and combines.

4. Worker Exposure
Farm workers who handle pesticides may be exposed to the harmful effects of these chemicals.

5. Endangered Species
Endangered species may be exposed to the harmful effects of pesticides applied to fields and crops in their habitat. Another threat is a reduction in their habitat caused by agricultural expansion.

6. Dietary Risk
Pesticide residues may remain on agricultural products that reach the consumer.

Pesticides play a role in most of these hazard pathways and are a critical focus of the environmental regulations that affect agriculture. Every pesticide must be registered with EPA's Office of Pesticide Programs (OPP). OPP reviews the health, safety, and environmental effects of these pesticides and, from time to time, issues regulations that restrict or prohibit the use of certain pesticides that are judged to present an unreasonable adverse affect. EPA also issues regulations controlling the operation and repair of underground storage tanks, and many other agricultural activities that may present environmental hazards.

These regulations affect both large and small farms in the U.S. Restrictions on the use of certain pesticides may require the substitution of more expensive pesticides and/or may reduce crop yields. Other environmental regulations may impose extra operating costs or may require additional investments in land preparation or farm equipment.

The ability of farms to comply with these environmental regulations will depend not only on the 'costs of each regulation and the effects of the required activities on agricultural yields, but also on the financial condition of each farm, the market conditions at the time the regulations become effective, and the number of farms that are covered. While some environmental regulations apply to all farms, most apply to only a portion of all farms, such as those that use a certain pesticide or have underground storage tanks.
Although the average net farm income in 1984 was identical to that in 1971 -- $12,000 in constant 1986 dollars -- the financial condition of U.S. farms has fluctuated dramatically over the past

two decades. Higher prices, expanding exports, and low real interest rates combined in the early 1970s to produce not only record farm incomes ($25,300 average in 1973), but also a rapid expansion in agricultural production. Unfortunately, these trends all reversed in the early 1980s. Prices declined, exports decreased, and interest rates rose at an unprecedented rate. Average net farm income fell to a low of $10,200 in 1981 and did not surpass the $12,000 level until 1985. Declining incomes led to declining farmland values and increasing debt-asset ratios. Recently, this trend has begun to change. Decreased production expenses, increased government payments, and lower interest rates have allowed net incomes to rise to an average of $14,000 and have slowed the decline in farmland values. The average debt-asset level in 1987 is expected to show a decline from 1986.

Trends for the average farm may belie significant differences within farm size categories and types. During the 1982-1985 period, farms specializing in vegetables, melons, and other specialty crops enjoyed average incomes of $60,000 per year. These farms, however, account for only a small portion of all farms. Farms producing cash grain, tobacco, cattle-sheep-and-hogs, general livestock, and animal specialties all had average incomes of less than $10,000 per year. These farms account for 70% of all farms and nearly 50% of farm marketings.

The financial condition of a farm, and hence its ability to comply with environmental regulations, may vary dramatically even within size categories and types of farms. For example, a study of the financial characteristics of U.S. farms in 1985-1986 showed 55% of all commercial farms were in a favorable financial situation, while 39% were in a marginal situation, and 3% were financially vulnerable.

STUDY METHOD AND LIMITATIONS

This study consists of an in-depth examination of the cumulative impact of environmental regulations on selected livestock, major field crop, and specialty crop producers. The approach of examining only a limited set of producers was chosen because the primary goal of determining the cumulative impact of EPA actions on the financial condition of producers requires an extensive amount of data collection and analysis. The approach followed in this study is summarized as follows:

1. Define alternative scenarios of EPA policies.
2. Select a subset of livestock, major field crop, and specialty crop producers for analysis.
3. Obtain cost and yield change information from EPA Program Offices.
4. Estimate price changes resulting from EPA actions (under each scenario) for each of the selected crops and livestock.
5. Define "impacts" for selected producers.

6. Examine the change in the financial condition of selected producers under each scenario.

Definition of Policy Scenarios

Because it is difficult to predict future EPA decisions for many regulations, the study examined three alternative scenarios corresponding to a range of potential policies. The scenarios can be summarized as follows:

SCENARIO 1: Past and current EPA actions plus a conservative (low cost) set of assumptions about future actions.

SCENARIO 2: Past and current EPA actions plus an intermediate (mid cost) set of assumptions about future actions.

SCENARIO 3: Past and current EPA actions plus an expansive (high cost) set of assumptions about future actions.

Past and current EPA actions that were included in each scenario are:

EDB - cancellation,
Toxaphene - cancellation,
Dinoseb - cancellation,
SARA Title III,
Leaking Underground Storage Tanks,
Farm Worker Protection Standards,
Chlorodimeform - cancellation of yield enhancement,
Alachlor - restricted use.

The scenarios also include alternative assumptions (high, mid, and low cost) about. EPA actions in the following areas:

Fungicides
Corn Rootworm Insecticides
Broad Spectrum Organophosphates
Grain Fumigants
Pesticides in Groundwater Strategy
Lead in Gasoline Phaseout

Detailed information concerning the assumptions about future policies made under each scenario are provided in Appendix A. The scenarios in this study include only direct impacts of federal EPA actions. Indirect impacts, such as effluent regulations on pesticide manufacturers, may result in increased costs to farmers, however, it was beyond the scope of this study to determine the extent to which higher production costs incurred by agricultural input industries would be passed on to farmers in the form of-higher input costs. Environmental protection actions which may be taken at the state level are also not considered in this study. Finally, this study does not account for voluntary actions taken by farmers (e.g., voluntarily ceasing to use a pesticide prior to cancellation).

Crop and Livestock Selection

A crucial step in this study was determining which producers to focus on. An effort was made to include those producers who were likely to experience relatively large impacts under the alternative policy scenarios considered. The cases that are examined, therefore, provide a variety of impact levels, but include worst case examples. The selection of livestock and major field crop producers was enhanced by the availability of an econometric simulation model, AGSIM, that indicated which crops and livestock were likely to be most affected. For livestock and major field crops, three specific producer categories were examined. Since the ability of any given type of producer to survive cost and yield affects associated with EPA actions is a function of his initial financial condition, two alternative financial conditions were examined for each of the livestock and major field crop producers considered:

* the average financial condition of all producers of the commodity and region considered, e.g., the average of all Illinois corn soybean farmers, and

* the average financial condition of all producers of the commodity and region considered that are in a "vulnerable" financial position. Vulnerable producers are defined as those that have debt to asset ratios greater than 0.4 and have a negative net cash income.

This resulted in the examination of six different representative livestock and major field crop farms:

* Illinois Corn Soybean Farm
    - in average financial condition
    - in vulnerable financial condition

*'Mississippi Cotton Soybean Farm
    - in average financial condition
    - in vulnerable financial condition

* Kansas Cattle Wheat Farm
    - in average financial condition
    - in vulnerable financial condition

The selection of specialty crops was more difficult than the selection of livestock and major field crop producers since specialty crop production is more diverse and information on pesticide usage is much more limited than for major field crops. In addition, no information was available on the initial financial condition of specialty crop producers. Through discussions with staff at EPA's Office of Pesticide Programs, the following set of specialty crops was selected:

* apples,
* tomatoes (fresh and processing treated separately),
* peas,
* potatoes,
* peanuts, and
* caneberries.

Analyses were not completed on peanuts and caneberries due to data. acquisition problems.

Obtaining Crop and Yield Effects

The EPA Program Offices provided information on the cost and yield effects (by crop and by region) that were expected to result from each individual action considered. In addition, they estimated the percent of farms of a particular type and region that were expected to incur each of the effects.

Estimation of Price Changes

EPA actions may increase fixed and variable costs, decrease yields, and affect production decisions. These impacts may in turn be translated into commodity price changes. Failure to account for these price changes would result in overestimation of the impact of EPA actions on farmers who bear the initial cost of EPA policies and would overlook the potential gain to producers who are not directly affected by EPA actions.

In order to estimate the price changes that might occur due to the impact of EPA actions on livestock and major field crop producers, a regional econometric-simulation model, AGSIM, was utilized. AGSIM includes eight major field crops and five types of livestock. The effects of EPA policies are entered into AGSIM as per-acre cost and yield changes for each crop in each of ten United States Department of Agriculture (USDA) production regions. A more detailed-description of AGSIM is provided in Appendix B of this report.

A national price-quantity model developed by Erik Lichtenberg, Douglas Parker and David Zilberman was utilized to estimate price changes due to the impact of EPA actions on specialty crop producers. This model is much more limited than AGSIM. It does not account for variation in impacts among different regions (only one national production cost change is used, which represents a weighted average of individual regional impacts). It also does not account for impacts on substitute crops that are not affected directly (e.g., a regulation that increases the price of broccoli may in turn increase the demand for, and price of, cauliflower). A more detailed description of the national price-quantity model used for specialty crops is provided in Appendix C.

Defining "Impacts" for Selected Producers

Since we are simultaneously examining the effect of several EPA policies, a fundamental issue to be determined was: how is an "impacted" farmer defined? For example, an Illinois corn soybean farmer may be affected by the cancellation of several different pesticides, may incur insurance costs if he has an underground storage tank that meets certain criteria, and may incur an expense to rebuild his leaded gasoline tractor engine if all lead is banned from gasoline. How many of these potential costs do we assume the "impacted" farmer incurs? For each producer, two alternative sets of financial impacts were examined:

* Maximum Impact Case: This case assumes that the producer is impacted by every regulation that may possibly affect a producer of that type.

* Average Impact Case: This case assumes that the producer experiences the average impact of producers of that type - e.g., if 10 percent of all producers of a given type (such as Illinois corn producers) experienced a cost of $1000, we would utilize a $100 cost ($1000 x 0.1) for the average impact case.

Estimation of Financial Effects on Selected Producers

In order to examine the effect of EPA policies on the selected producers of major field crops and livestock, a whole farm recursive programming simulation model of representative producers, REPFARM, was used (see Appendix D for a description of REPFARM). REPFARM model for each of the selected producers was developed by USDA. The REPFARM models were simulated over the 1987-1996 period, using the average and maximum cost and yield impacts for each policy scenario and the scenario specific prices derived from AGSIM. The effect of EPA policies on each of the representative farms' financial condition was determined by examining:

* the change in net cash farm income 1/, and
* the change in debt to asset ratio.

This examination provides information on the effect of EPA actions on the producers' income and ability to survive. It is assumed that a farm goes out of business when its debt to asset ratio reaches one -- i.e., its level of debt is equal to its assets.

1/ Net cash farm income is defined as cash farm income minus farm expenses. It includes both property tax payments and income from government programs. It does not include depreciation of machinery and buildings or off-farm income.

There is only limited information on the baseline financial conditions of specialty crop producers. Therefore, our ability to determine the impact of EPA actions on their financial condition is more limited than for livestock and major field crop producers. The impact of EPA actions on specialty crop producers was estimated by examining the change in net returns per acre for producers in different production regions. Net returns, for the purposes of this report, consist of all farm income minus all farm expenses, with the exception of non-hired labor and land, on a per acre basis. Net returns per acre, therefore, reflect the return to land and farmer provided labor.

Budget information was collected for each of the selected specialty crop producers in several different production regions to establish a baseline level of net returns. The specialty crop budgets for each region were then projected over the 1987-1996 period using the average and maximum impacts for each region under each policy scenario along with the scenario specific prices (determined by the national price-quantity model). This projection provides information on the change in net returns per acre for producers in different regions under each policy scenario (see Appendix E).

Study Limitations

The complexity of the agricultural sector, the uncertainty associated with many environmental regulations, and data and modeling limitations necessitated the use of many simplifying assumptions. Each of the study's major limitations is discussed in more detail below;

Examination of a Limited Number of Commodities

As discussed above, data and analytical requirements associated with the objectives of this study necessitated choosing a limited set of commodities to examine. Producers of crops not considered in this report will experience different levels of impacts; however, an effort was made to include producers that are expected to experience relatively large impacts.

Limited Information About Producer Baseline Conditions

In addition to EPA actions that will affect different crops to varying degrees, producers of the same crop will also be affected to varying degrees depending on their: (1) geographic location (e.g., different regions use different pesticides) and (2) baseline production and financial characteristics. Marginal producers may be forced out of production, while producers in more favorable financial condition will be able to withstand greater impacts. Information on the initial financial condition of the representative livestock and major field crop producers was available. However, numerous assumptions about future prices, government policies, interest rates, and cost and yield trends affect the baseline projections (predicted under the assumption of no EPA policy impacts) of net cash farm income and debt to asset ratios obtained from the REPFARM models. If these assumptions result in an overestimate of the financial strength of the representative farms in the baseline, then we will overestimate the ability of producers to survive in the face of EPA actions. Likewise, if these assumptions result in an underestimate of the financial strength of the farms, then we will underestimate the ability of producers to bear the costs of EPA actions. More information about the specific assumptions used in the REPFAFM model is supplied in Appendix D.

Sensitivity analysis reveals that assumptions about crop yields and future crop prices have a large effect on the REPFARM model results. For example, upper and lower sensitivity runs were made assuming that prices were 15% higher and lower respectively in the years 1991-1996. The resultant estimates of net cash farm income in the upper sensitivity runs were double those in the lower sensitivity runs. This analysis illustrates the sensitivity of the results of this study to critical assumptions, and helps to place the magnitude of the predicted effects in perspective relative to the other factors that influence farms' financial health.

Only limited information was available on the baseline financial conditions of specialty crop producers. Crop enterprise budgets for the selected specialty crops were collected from the Agricultural Extension Service in major producing states, which provided information necessary to calculate the net returns per acre for each crop/region examined. However, information on the debt to asset ratios of specialty crop farmers, or their total net farm income was unavailable. The limited information on baseline financial conditions makes it difficult to determine whether the EPA actions assumed in alternative scenarios would actually cause the specialty crop producers examined in this study to go out of business.

Uncertainty about Future EPA, and other Government Agency Actions

In order to complete this study, it was necessary to make assumptions about what actions EPA might take in the next five years. There is obviously a tremendous amount of uncertainty about which actions will be undertaken in the future. This study does not presume to accurately predict future actions of the Agency. Rather, it attempts to define a range of impacts that correspond to a plausible range of future policy scenarios.

In addition, this study does not account for possible indirect impacts on agricultural producers (through regulation of agricultural input industries) and does not account for actions taken at the state level. To the extent that state actions further increase production costs or decrease yields, failure to account for these actions results in an underestimate of the direct effects on farms due to environmental and health concerns. State actions may be especially significant for the livestock industry, which is a major source of nonpoint source (NPS) pollution. Under legislation passed in February, 1987, states were given grants to assess the magnitude of the NPS problem and to develop management plans, which are due at EPA by August 1988. State actions in the NPS area, however, are not accounted for in this analysis. This omission may be particularly significant for the KS wheat cattle farm.

Another potential bias created by not modeling state level actions occurs in the Pesticide in Groundwater Strategy. In this analysis, federal Pesticide in Groundwater Strategy actions were assumed. In reality, states may take action on their own, circumventing federal level action. If state actions are less severe than the federal level actions assumed in this analysis, then these results may tend to overestimate the magnitude of the Pesticides in Ground-water Strategy.

Finally, this study does not account for possible changes in USDA policies in response to income losses generated by EPA actions. Agricultural programs may tend to cushion the effects of EPA regulations. For example, crop insurance would protect farmers from the losses caused by removal of important pesticides during periods of infestation.

Uncertainty About the Incidence and Magnitude of EPA Impacts

Once a policy scenario is defined, predicting which producers will be impacted requires an extensive amount of information. For example, if a particular pesticide is to be canceled, detailed usage data is required to predict which producers will be affected. Pesticide usage data for major field crops are available at state and multi-state production region levels (based on statistically valid samples collected by USDA and other sources). However, these data are not reliable at a county level. This created problems in predicting the impacts of the Pesticides in Groundwater Strategy, since this program was assumed to result in county specific pesticide cancellations. Data provided by a contractor were used to determine the incidence of Pesticides in Groundwater actions. However, this data base is composed of information drawn from available reports and expert opinions of local Cooperative Extension Service personnel and is not baaed on a statistically valid sample.

Predicting the incidence of EPA actions on specialty crops is especially difficult because there is less information about pesticide usage on these crops than on major field crops. Much of the specialty crop pesticide usage data utilized in this analysis were derived from private data collection agencies (e.g., Doanes) that do not provide information on the sampling techniques utilized in collection. The lack of reliable pesticide usage information for specialty crops severely limits the reliability of conclusions drawn in this study. A more detailed discussion of the data and assumptions used in this analysis is provided in Appendix F.

In addition to knowing what types of producers are likely to be affected by each EPA action, it is important to determine the extent of the impact. For a pesticide cancellation, this requires knowing what alternative will be used in place of the cancelled pesticide and what cost and/or yield variations the user will experience with this alternative. These efficacy data are not always readily available, and are based primarily on expert judgement rather than on models of farmers' responses to regulations and the resulting crop and yield effects. The lack of reliable efficacy data increases the uncertainty associated with predicting impacts of EPA actions. Furthermore, there was not sufficient information to fully account for changes in quality (e.g., size, shape) brought about by restrictions of pesticides.

Finally, effects of pesticide cancellations were projected to dissipate evenly over a seven year period as users adjust their practices and new pest control products become available. The use of an arbitrary assumption of this type was necessitated by the lack of a reliable method to predict the development of substitute pest control products and the adjustment in agricultural practices over time. Clearly this assumption may overestimate the adjustment process for some cancellations and underestimate it for others. Some commodities, such as apples and oranges, are less' able to adjust to pesticide cancellations through the use of more pest resistant species due to the long term structure adjustment problem associated with tree removal and replacement.

Model Assumptions

In addition to assumptions about the incidence and magnitude of ‘impacts, the models themselves utilize assumptions that affect the results. For example, the assumptions about elasticities of supply and demand that are used in the national price-quantity models are crucial in determining the extent to which EPA impacts are passed on to consumers in the form of higher prices. Elasticities are often listed as a range of numbers and are for a wide category of crops rather for a specific crop.

RESULTS OF LIVESTOCK AND MAJOR FIELD CROP IMPACT ANALYSES

As previously discussed, the change in the financial condition of selected livestock and major field crop producers was examined using USDA's REPFARM model. Changes in financial condition are measured by changes in net cash farm income and changes in debt to asset ratios that are caused by EPA actions under each of the three scenarios. Assumptions about initial characteristics of the representative producers along with the cost and yield effects assumed for each EPA action are presented in Appendix D.

All of the different farm types and level of impacts that were considered in our analysis resulted in 36 sets of output; therefore, all the results are not presented in this report. Only the results of Scenarios 1 and 3 for the farms in average financial condition are presented here. These results provide a range a impacts that are predicted for the case study farms in average financial condition. A brief discussion is provided as to how the results for the farms in vulnerable financial condition differ from those in average financial condition. In viewing these results it should be recognized that many factors influence the financial condition of a farm. Accordingly, the actual impact that the EPA policies considered in this study would have on any particular farm may differ from the results presented here.

Illinois Corn Soybean Farm

There are 30,837 farms in Illinois that are classified as cash grain farms that produce corn and soybeans. Survey observations of these farms were used to develop the baseline characteristics of the Illinois corn soybean REPFARM in average financial condition (See Appendix D for a description of baseline characteristics of each REPFARM model). There are 112,489 farms in the five state Cornbelt region (Iowa, Illinois, Indiana, Missouri, Ohio) that fit the corn soybean farm definition.

Illinois Corn Soybean Farm in Average Financial Condition

SCENARIO 1

Figures l-a and l-b indicate the net cash farm income and debt to asset ratios, respectively, of the representative Illinois corn soybean farmer (average financial condition) under Scenario 1. The maximum impact case (which assumes the producer incurs all possible cost and yield impacts) results in a mean annual decrease in net cash farm income of $2,900. This represents an eight percent average annual decrease from the baseline. The mean decrease under the average impact case (which assumes the producer experiences the average costs and yield impacts of all similar producers), however, is significantly less at $270, or less than one percent of the baseline net cash farm income. The substantial gap between the average and maximum impact cases is due primarily to the underground storage tank regulation. The costs associated with this regulation are substantial, yet only a small percentage of farmers are affected. 2/

A reduction in net cash farm income due to EPA policies may result in increases in farmers' debt to asset ratios in two ways: (1) it decreases the return to land and, therefore, the value of land (which is the primary component of farm assets) and (2) it may cause farmers to borrow funds if they are put into a position of negative

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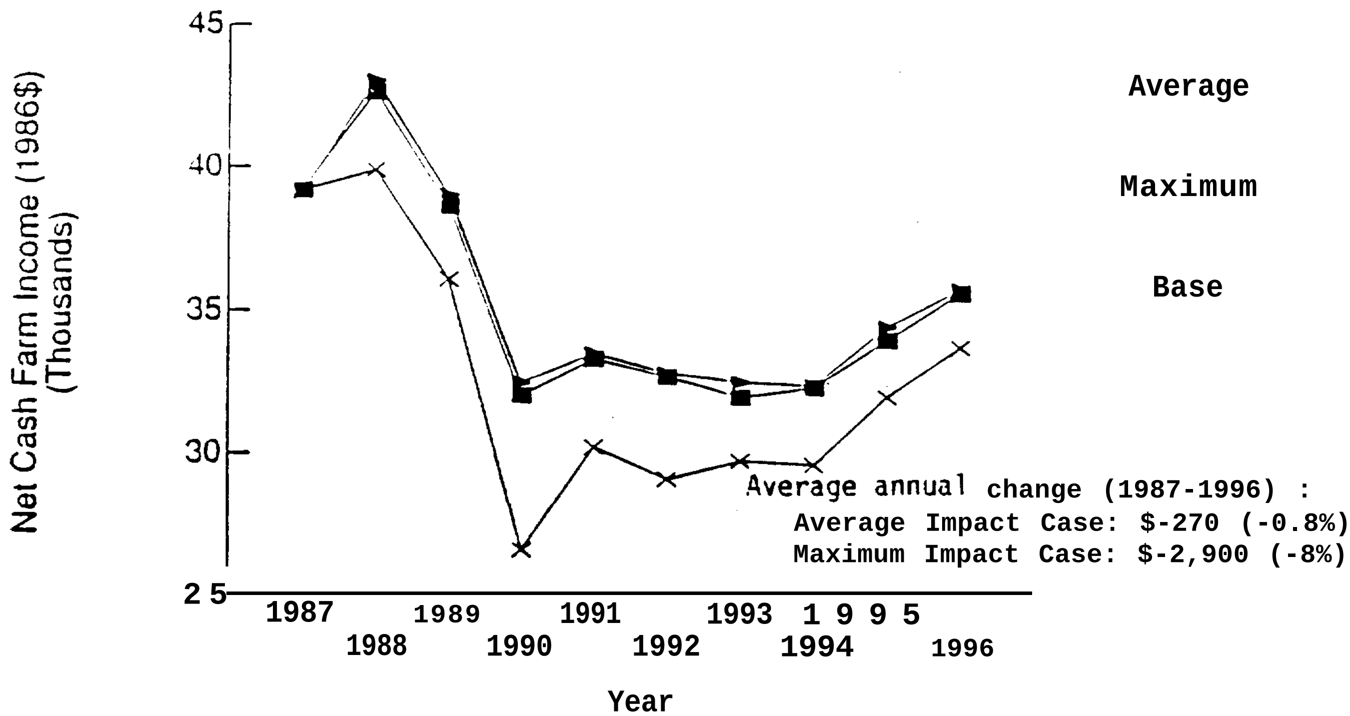
2/ Farmers having a petroleum underground storage tank (>llOO gallons) were assumed to incur $25OO/yr. insurance cost (1988-1996) and a $500 charge in 1991 and 1994 for a tank tightness test. No costs were included for remedial action and it was not assumed that any farmers would remove their USTs.

Illinois Corn Soybean Farm: Scenario 1

a.



b.

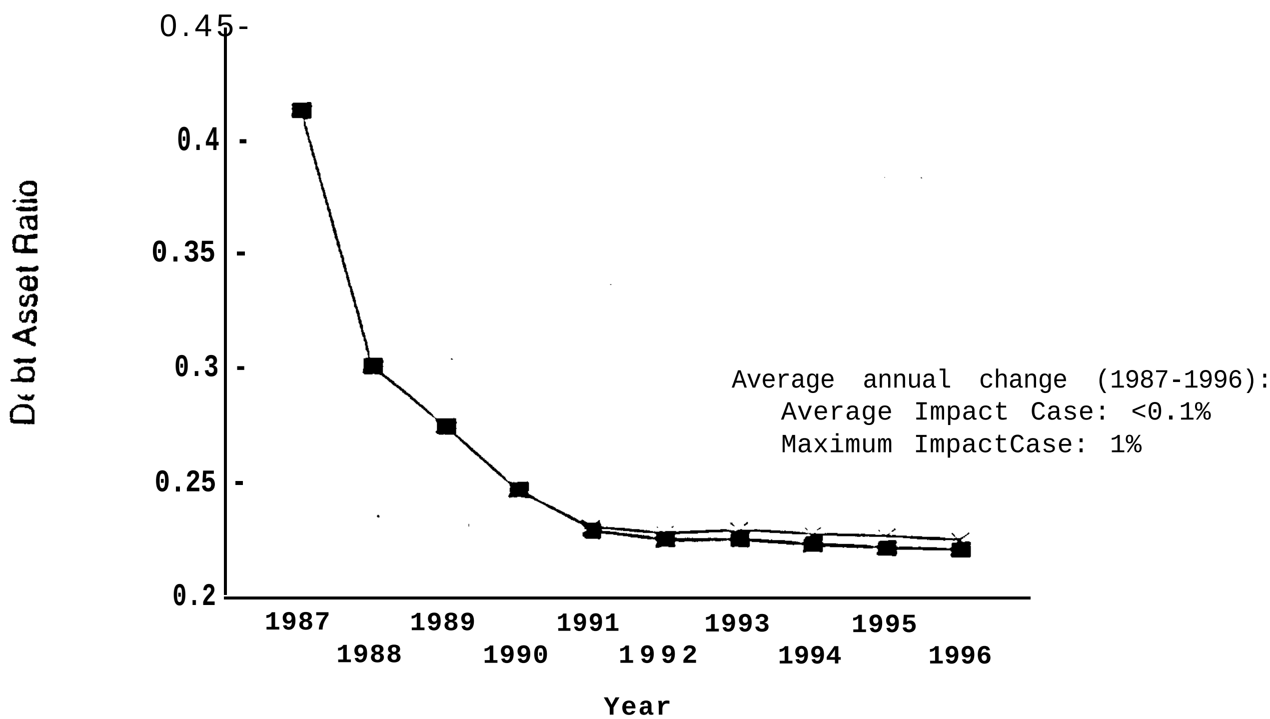


Figure 1. EPA impacts on net cash farm income and debt asset ratio for a representative Illinois corn soybean farm in average financial condition: Scenario 1

cash flow. The debt to asset ratio in each REPFARM model may be viewed as an indicator of the producer's ability to survive. Producers are assumed to go out of business when their debt to asset ratio equals one.. As seen in Figure l-b, the maximum impact case results in a very slight increase in debt to asset ratios under Scenario 1 (one percent) while no significant change in the debt to asset ratios occurred for the average impact case.

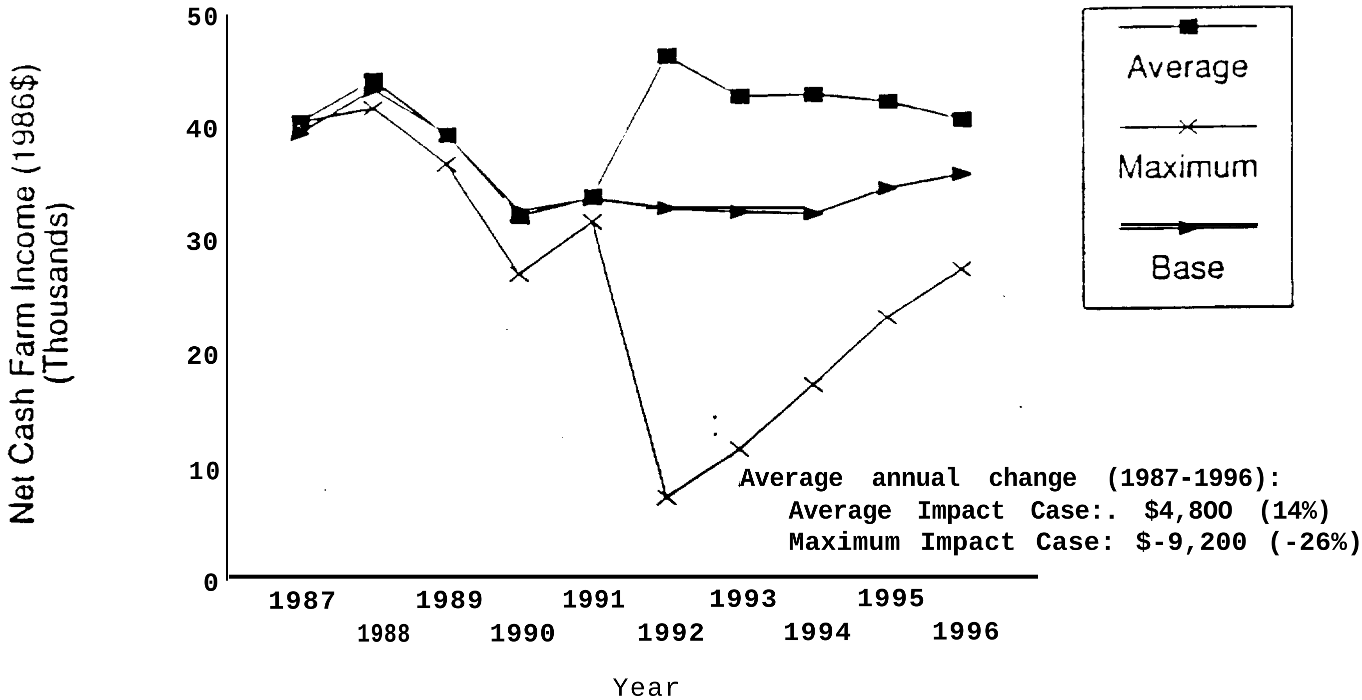
SCENARIO 3

Under the expansive set of EPA actions (Scenario 3) the maximum impact case results in an average annual decrease in net cash farm income of $9,200 (Figure 2-a) and an average annual increase in debts to assets of two percent (Figure 2-b). These substantial impacts are due primarily to assumptions about restrictions on the use of alachlor, triazines and corn rootworm insecticides. The average impact case, however, results in an increase in average annual net cash farm income. This occurs because the larger cost and yield changes incurred by affected corn and soybean farmers under Scenario 3 reduced production levels and raised corn and soybean prices. These higher prices more than offset the cost and yield impacts assumed in the average impact case. The average annual increase in net cash farm income for the average impact case is $4,800 (14 percent increase from the baseline). This results in a slight improvement in the debt to asset ratio.

The large difference between the results in the average and maximum impact cases highlights the importance of understanding the distributional implications of EPA policies. Because initial price and yield impacts are not distributed evenly among farms, producers will experience different financial impacts. In cases where EPA actions result in commodity price increases, farmers who experience relatively small crop and yield effects may actually benefit from the policies. In order to provide more insight into the distribution of cost and yield impacts expected under alternative scenarios, a cumulative probability cost curve was generated for each of the representative producer in average financial condition under each scenario. These curves indicate the probability that each representative farm will incur a cost less than or equal to a given level. (See Appendix G for a complete description of these curves) . The discounted present value of the cost and yield impacts (1987-1996) incurred under the maximum impact case in Scenario 3 is over $60,000. However, Figure 3-b indicates that under Scenario 3 the representative Illinois corn soybean farm in average financial position has a .7 probability of incurring discounted present cost and yield impacts (1987-1996) that are less than $28,000; and a .5 probability of incurring impacts of less than $5,000. The cumulative probability cost curves illustrate that the maximum impact cases described here represent a set of very unlikely worst cases. The average impact cases presented in this section provide insights into the financial effects that each of the representative farms examined would have a significant chance of incurring. As indicated in Figure 3-b, under Scenario 3 the representative

Illinois Corn Soybean Farm: Scenario 3

a.



b.

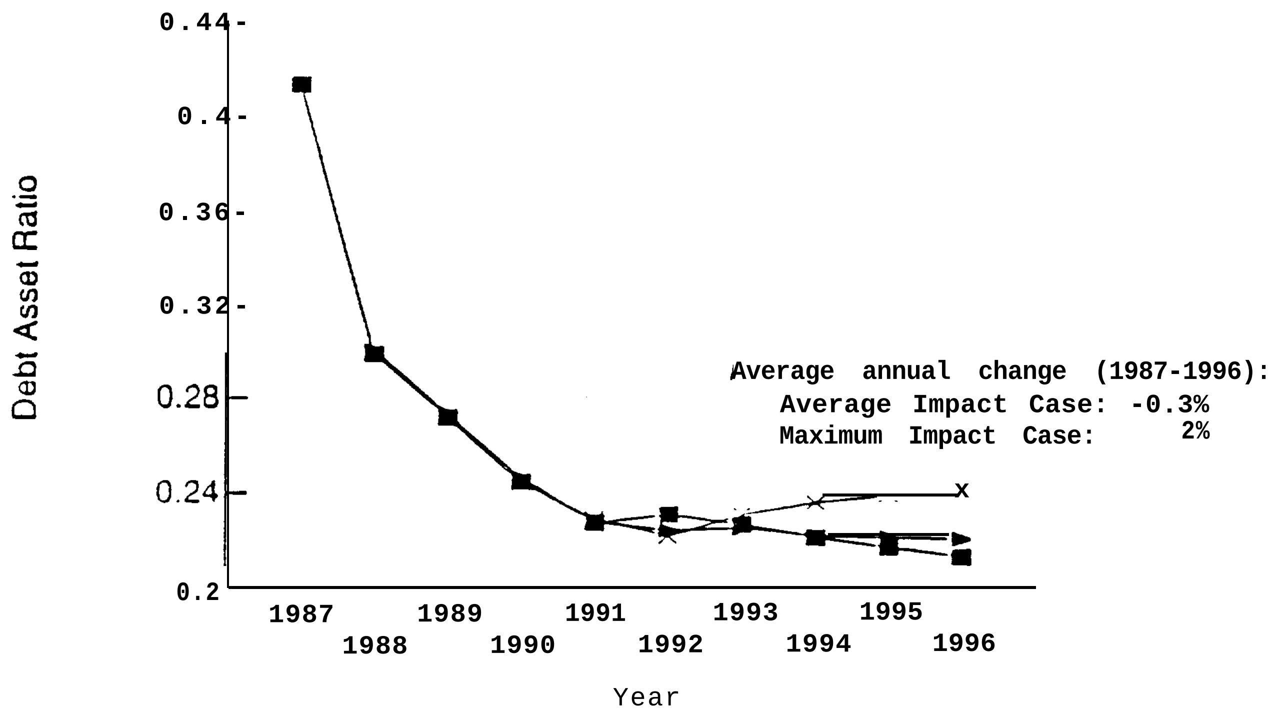


Figure 2. EPA impacts on net cash farm income and debt asset ratio for a representative Illinois corn soybean farm in average financial condition: Scenario 3

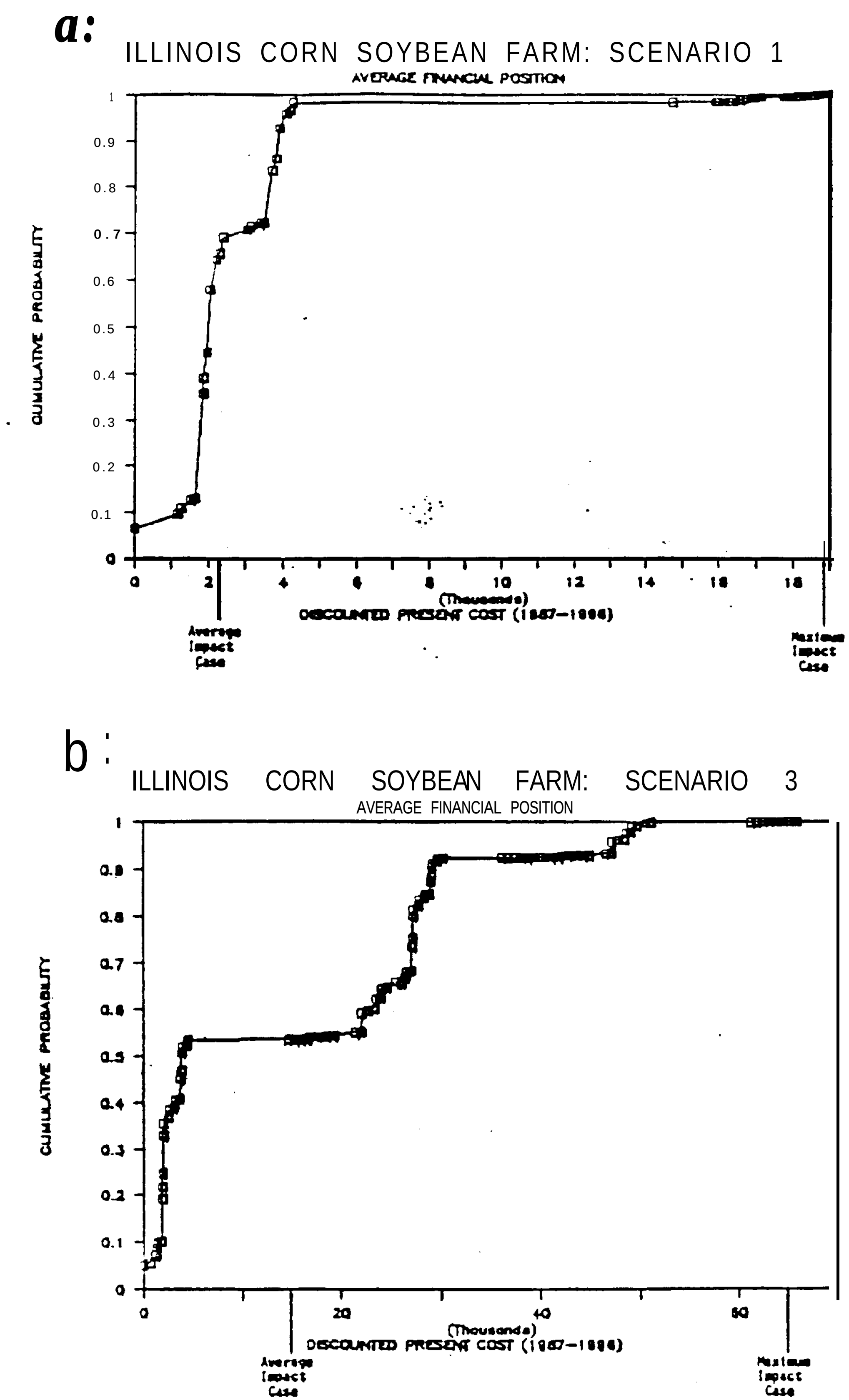


Figure 3. Cumulative probability cost curves for a representative Illinois corn soybean farm in average financial condition: Scenarios 1 and 3

Illinois corn soybean farmer has a .45 probability of incurring cost and yield impacts that are greater than those corresponding to the average impact case and a .55 probability of incurring cost and yield impact less than those in the average impact case.

Illinois Corn Soybean Farm in Vulnerable Financial Condition

Results for the Illinois corn soybean farm in vulnerable financial condition are presented in Appendix D and are only summarized briefly here. Of the 30,837 Illinois corn soybean farms, approximately ten percent were determined to be in vulnerable financial condition. Survey observations on this group of farms were used to develop the characteristics of the Illinois corn soybean farm in vulnerable financial condition.

The absolute decrease in net cash farm income for the vulnerable farm under each scenario is approximately the same as the decrease experienced by the farm in average financial condition, however, the percentage reduction is greater because the base income level of the vulnerable farm is much less than that of the average farm (an annual average of $550 as opposed to $35,000). Likewise, the change in net cash farm income experienced by the vulnerable farm has a greater impact on its debt to asset ratio (e.g., the changes in debt to asset ratios for the maximum impact case under Scenario 3 are two percent and 22 percent for the Illinois farms in average and vulnerable financial condition, respectively). This result occurs because the lower base income of the vulnerable farm makes it more sensitive to changes in cash flow than its counterpart in average financial condition.

The difference in results observed for the vulnerable and average farm highlights the importance of understanding the baseline financial condition of farms when predicting how EPA actions will affect their ability to survive. Although EPA actions result in much greater changes in debt to asset ratios for the vulnerable farm than for the farm in average financial condition, the vulnerable farm is not predicted to go out of business, even under the most expansive sets of EPA actions.

Mississippi Cotton Soybean Farm Results

There are 1,798 farms in Mississippi that are classified as field crop farms producing cotton and soybeans. Survey observations on these farms were used to develop the Mississippi cotton soybean REPFARM in average financial condition. There are 3,576 farms in the three state Delta region (Mississippi, Arkansas, Louisiana) that fit the cotton soybean farm definition.

Mississippi Cotton Soybean Farm in Average Financial Condition

SCENARIO 1

The maximum impact case for the Mississippi cotton soybean farm in average financial condition results in a mean annual decrease in net cash farm income of $10,700 under Scenario 1 (Figure 4-a). The mean decrease in net cash farm income under Scenario 1 for the average impact case, however, is significantly less at $1,700. The gap between the average and maximum impact cases occurs because underground storage tank regulations, and dinoseb and toxaphene cancellations cause significant costs to impacted producers, but only affect a small fraction of producers. 3/ For example, only 1.2 percent of the soybean acres in Mississippi are thought to be affected by the cancellation of toxaphene and less than two percent of the farms are expected to have underground storage tanks.

Both the maximum and average impacted producers experience increases in their debt to asset ratios under Scenario 1 (six percent and .6 percent increases, respectively), yet neither producer is forced out of business (Figure 4-b).

The discounted present value of the cost and yield impacts (1987-1996) incurred under the maximum impact case in Scenario 1 is over $80,000. However, the cumulative probability cost curve for the Mississippi cotton soybean farm in average financial condition (Figure 5-a) indicates that it has a 70 percent chance of incurring discounted present cost and yield impacts (1987-1996) that are less than $10,000. The maximum impact cases described here, therefore, should be viewed as a set of very unlikely worst cases. The average impact case for Scenario 1 corresponds to a level of discounted present costs and yield effects that the representative Mississippi cotton soybean farm has a 25 percent chance of exceeding, and a 75 percent chance of having lesser impacts.

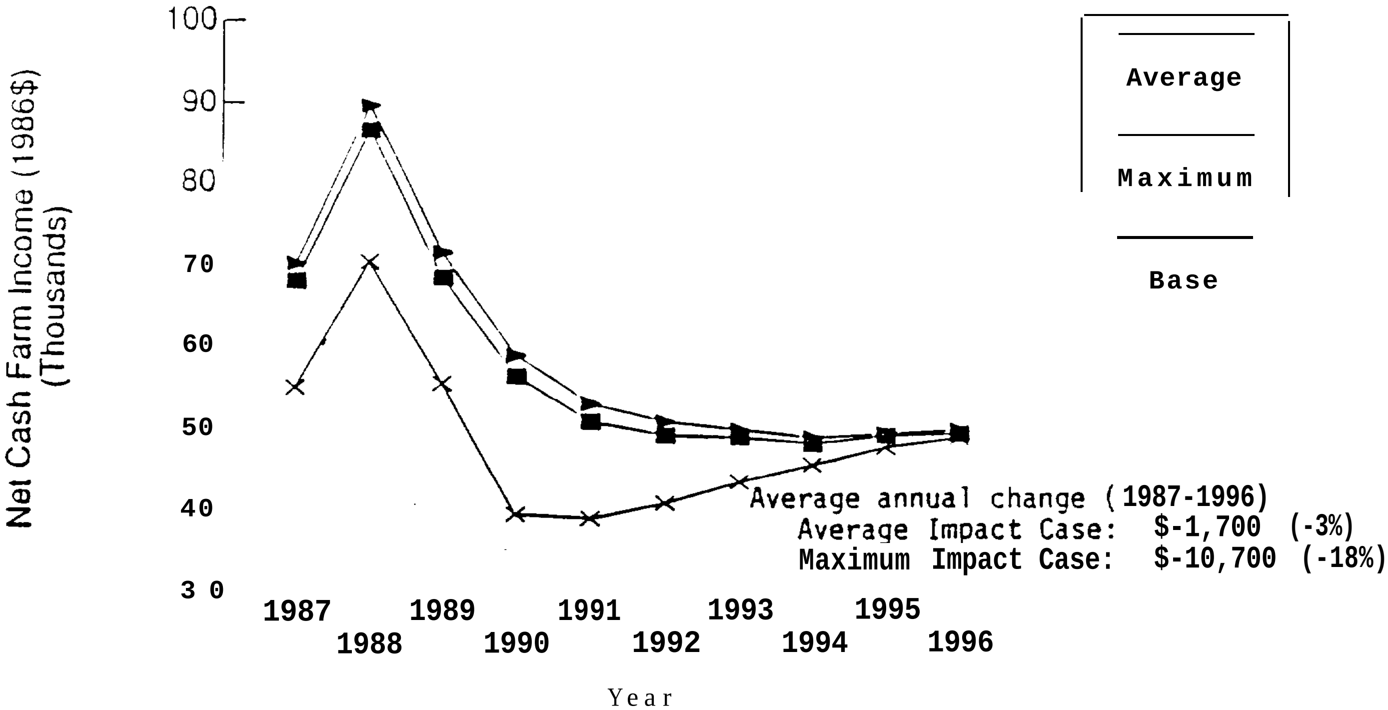
SCENARIO 3

Under Scenario 3, the maximum impact case results in an average annual decrease in net cash farm income of $14,200 (Figure 6-a) and an average annual increase in debts to assets of six percent (Figure 6-b). The loss in income is greater than that experienced under the maximum impact case for Scenario 1. The loss in income for the average impact case, however, is less under Scenario 3 than under Scenario 1 ($400 less, on average). This result occurs because the larger cost and yield changes incurred by cotton and soybean farmers as a whole under Scenario 3 reduce production and cause higher cotton and soybean prices. These higher prices cause the income of

3/ See Appendix D, Table D-6 for the cost and yield impacts and percent of acres treated assumed for the cancellation of dinoseb and toxaphene. Information about. UST assumptions may be found in both Appendix D and Footnote 1.

MS Cotton Soybean Farm: Scenario 1

a.



b.

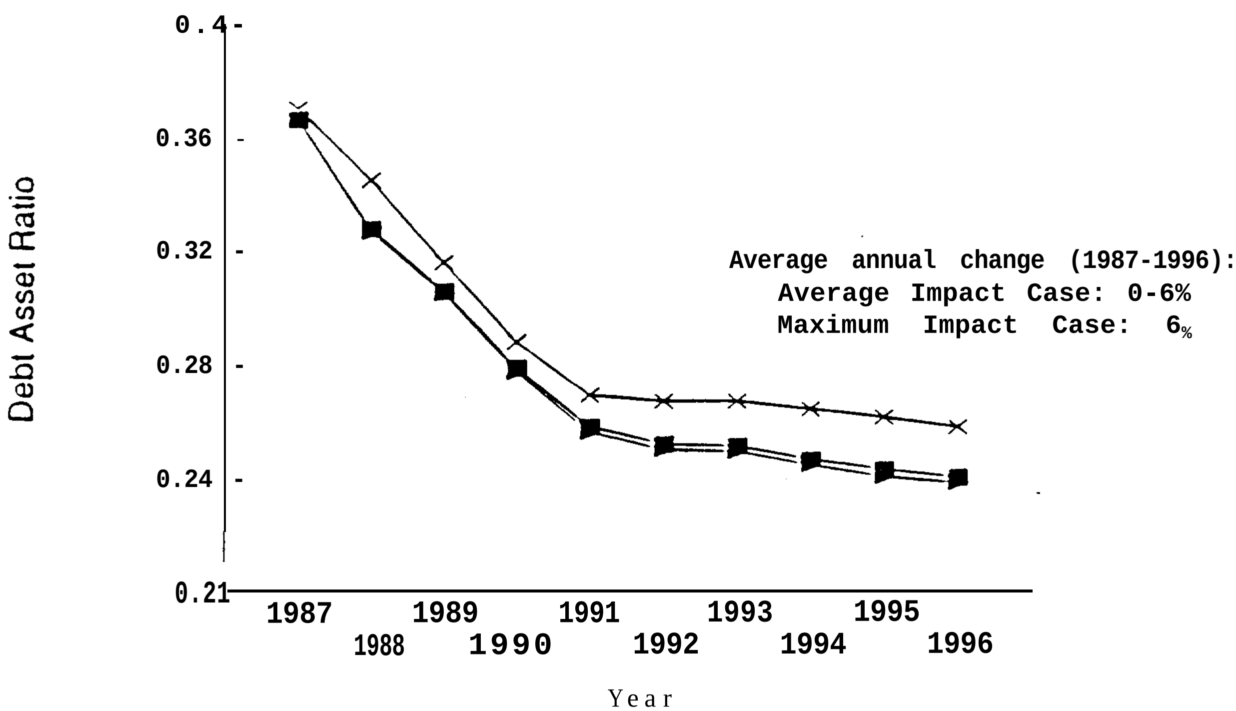
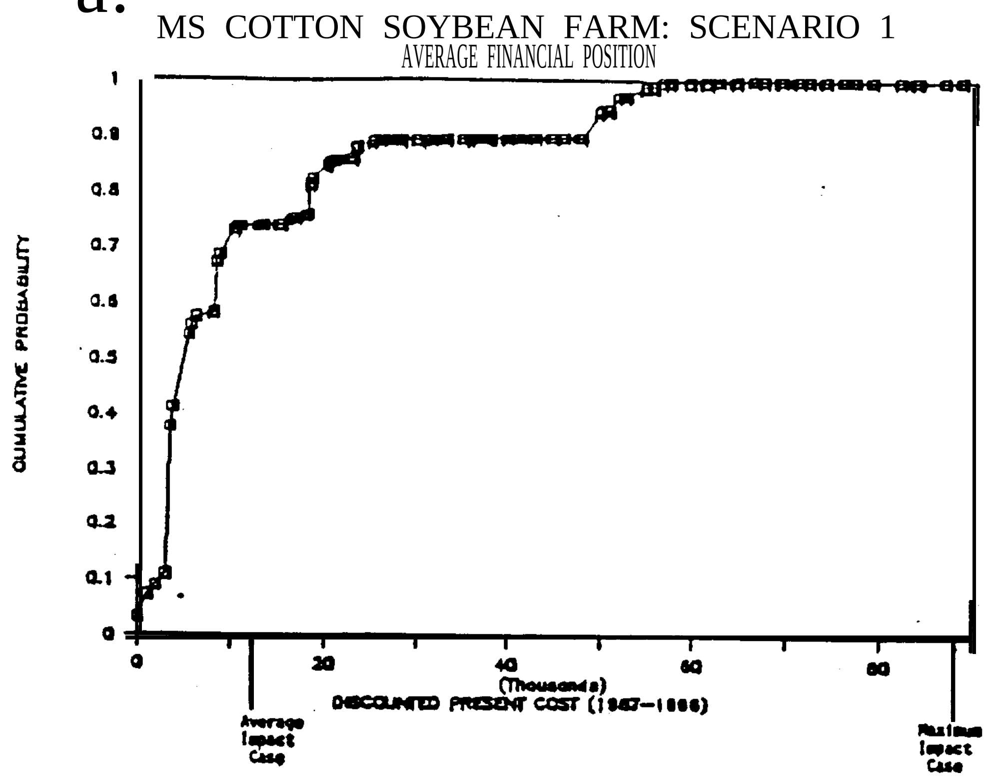


Figure 4. EPA impacts on net cash farm income and debt asset ratio for a representative Mississippi cotton soybean farm in average financial condition: Scenario 1

a:



b:

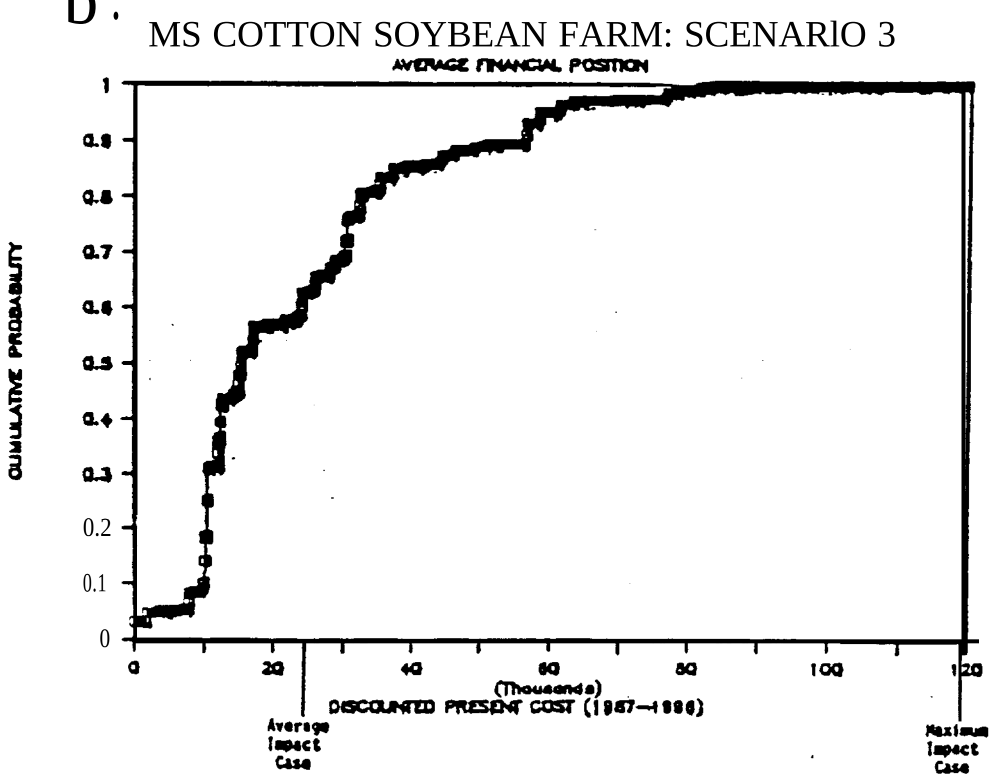


Figure 5. Cumulative probability cost curves for a representative Mississippi cotton soybean farm in average financial condition: Scenarios 1 and 3

MS Cotton Soybean Farm: Scenario 3

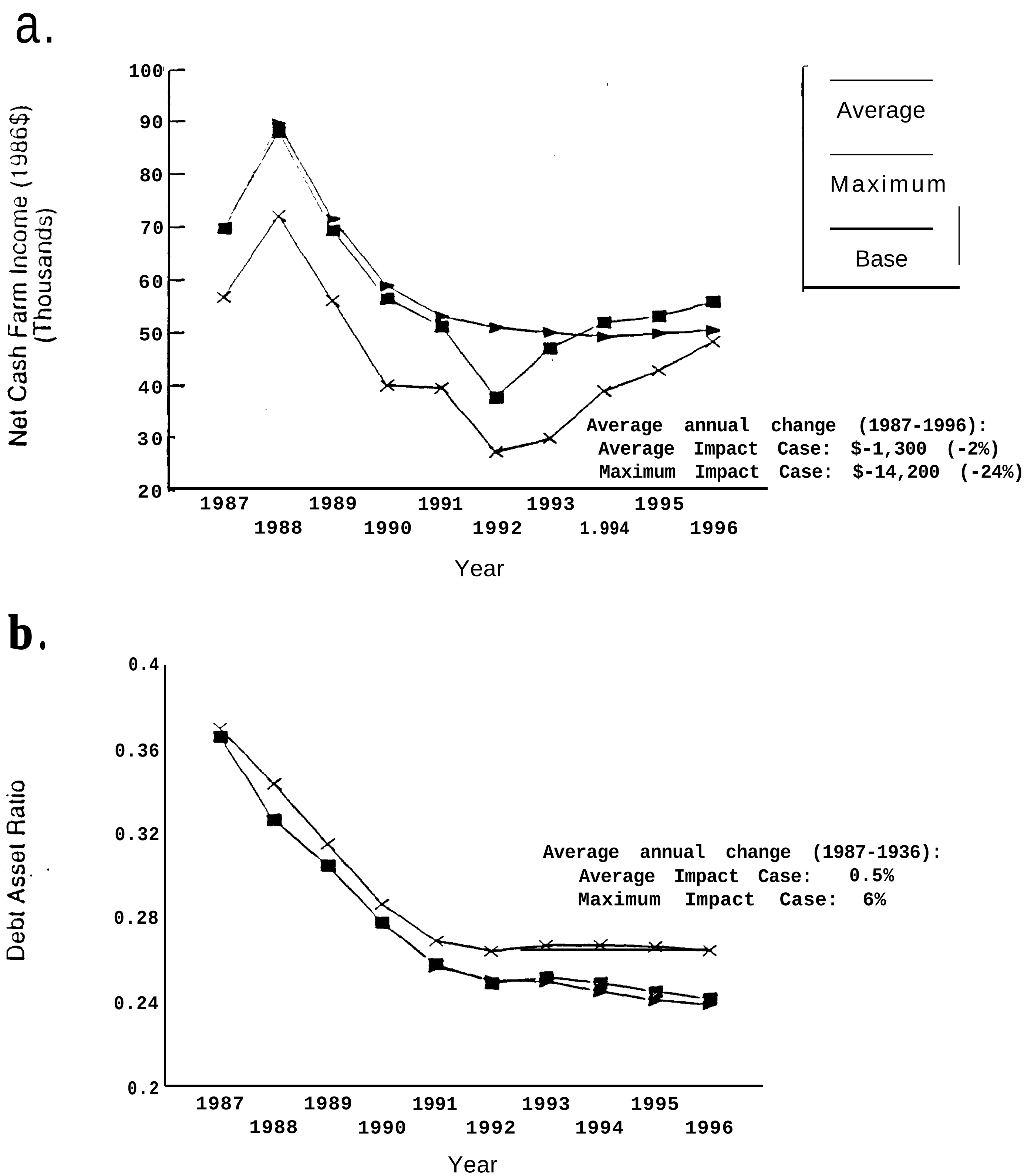


Figure 6. EPA impacts on net cash farm income and debt asset ratio for a representative Mississippi cotton soybean farm in average financial condition: Scenario 3

those farmers who incur only the mean cost and yield impacts to actually increase above the baseline in the years 1994-1996. As indicated in Figure 5-b, the average impact case corresponds to a level of cost and yield effects that the representative farmer has approximately a 40 percent chance of exceeding and a 60 percent chance of having lesser impacts.

Mississippi Cotton Soybean Farm in Vulnerable Financial Condition

The results of the Mississippi cotton soybean farm in vulnerable financial condition are presented in Appendix D and are summarized only briefly here. Of the 1,798 MS cotton soybean farms approximately 14 percent were determined to be in vulnerable financial condition and survey observations relating to this group of farms were used to develop the characteristics of the Mississippi cotton soybean farm in vulnerable financial position.
The reduction in net cash farm income experienced by the vulnerable Mississippi cotton soybean farm in each scenario is slightly greater than that experienced by the Mississippi cotton soybean farm in average financial condition -- e.g., for the average impact case under Scenario 1, the vulnerable farm has an average annual loss of income of $2,500, as opposed to the $1,700 loss experienced by the farm in average financial condition. This result occurs because the vulnerable farm has more cotton and soybean acres than the farm in average financial condition and, therefore, experiences greater total cost and yield effects. The larger cost and yield effects and a lower base income level for the vulnerable farm combine to result in larger changes in its financial condition than those experienced by the farm in average financial condition under each scenario. For example, under the average impact case for Scenario 3, the debt to asset ratio increases by over three percent for the vulnerable farm and by 0.5 percent for the farm in average financial condition.

Kansas Wheat Cattle Farm Results

There are 19,966 farms in Kansas that produce wheat and cattle. Survey observations of these farms were used to develop the Kansas wheat cattle REPFARM in average financial condition. There are 50,143 farms in the four state Northern Plains region (Kansas, Nebraska, North Dakota, South Dakota) that fit the wheat cattle farm definition.

Kansas Wheat Cattle Farm in Average Financial Condition

SCENARIO 1

The maximum impact case results in a mean annual decrease in net cash farm income of $2,800 under Scenario 1 (Figure 7-a). The mean decrease in net cash farm income for the average impact case, however, is only $380. The substantial difference between the average and maximum impact cases is due primarily to the underground storage tank regulations which are expected to impact only two

Kansas Wheat Cattle Farm: Scenario 1

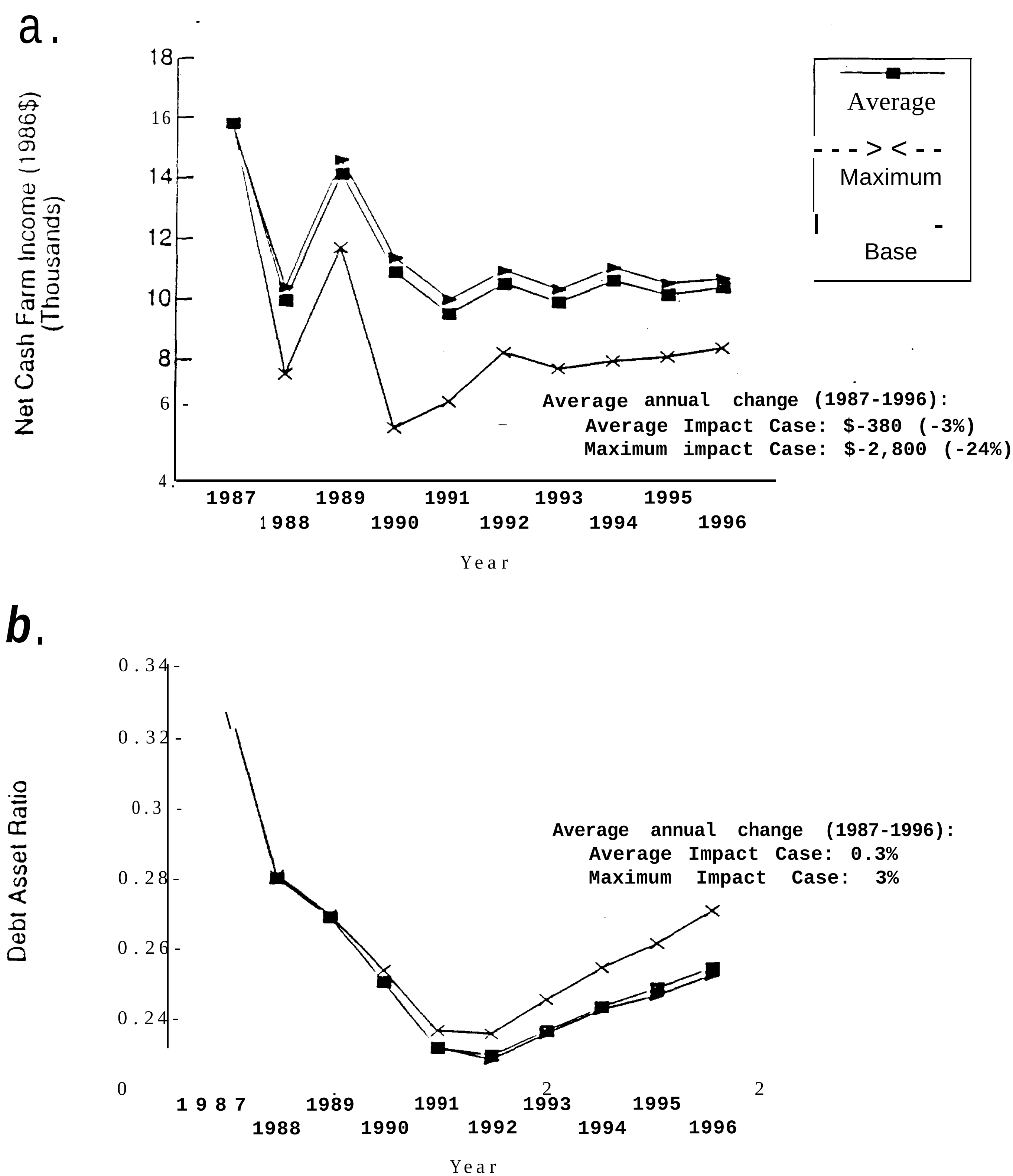


Figure 7. EPA impacts on net cash farm income and debt asset ratio for a representative Kansas wheat cattle farm in average financial condition: Scenario 1

percent of producers in the Northern Plains region. 4/ The representative Kansas wheat cattle farmer has a .65 probability of incurring cost and yield impacts that are less than those assumed in the average impact case (Figure 8-a). These cost and yield impacts are less than one-eighth of those assumed in the maximum impact case.

Under the average impact case, the producer experiences a slight (less than one percent) increase in his debt to asset ratio. The mean annual increase of debts to assets under the maximum impact case is three percent (Figure 7-b).

SCENARIO 3

Under Scenario 3, the maximum impact case results in an average annual decrease in net cash farm income of $9,700 (Figure 9-a) and an average annual increase in debts to assets of 22 percent (Figure 9-b). The reduction in income and increase in debt to assets under the maximum impact case for Scenario 3 is large enough to cause the Kansas wheat cattle farm to enter into the vulnerable farm definition by the end of the forecast period. This is the only case in which this result occurs.

The average impact case, however, results in an average annual increase in net cash farm income of $310. As with the Illinois corn soybean farm, this result occurs because the commodities produced (the representative Kansas wheat cattle farmer produces corn, soybeans, and sorghum as well as wheat and cattle) incur larger cost and yield changes under Scenario 3. These higher costs are passed on to consumers in the form of higher prices, causing the net cash farm income of those farmers who incur only the mean cost and yield impacts to actually increase above the baseline.

As illustrated in Figure 8-b, the representative Kansas wheat cattle producer has a .60 probability of incurring cost and yield impacts that are less than those corresponding to the average impact case for Scenario 3. It should be noted, however, that the discounted present costs presented in Figure 8 do not include the additional expense that the wheat cattle farmer would incur if EPA actions result in higher feed costs. These higher costs have been accounted for, however, in the REPFARM model.

Kansas Wheat Cattle Farm in Vulnerable Financial Condition

The results of the Kansas wheat cattle farm in vulnerable financial condition are presented in Appendix D and are briefly summarized here. Of the 19,966 wheat cattle farms in Kansas, approximately

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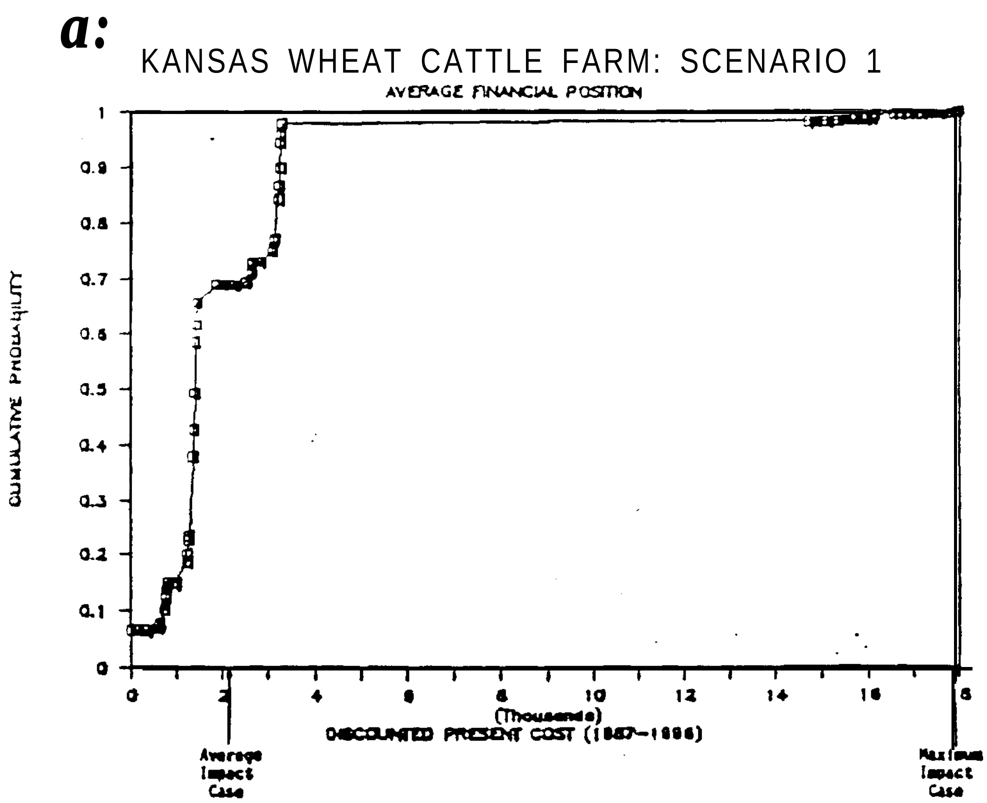
4/ See Footnote 1 for assumptions about the costs for underground storage tanks.



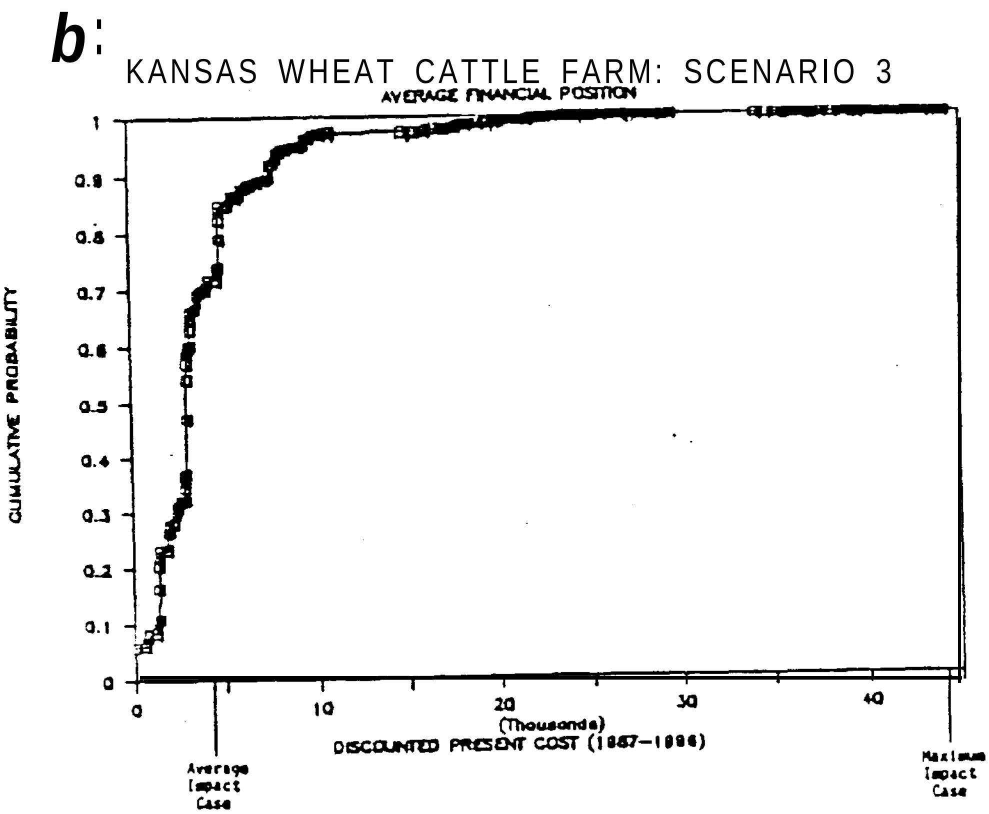
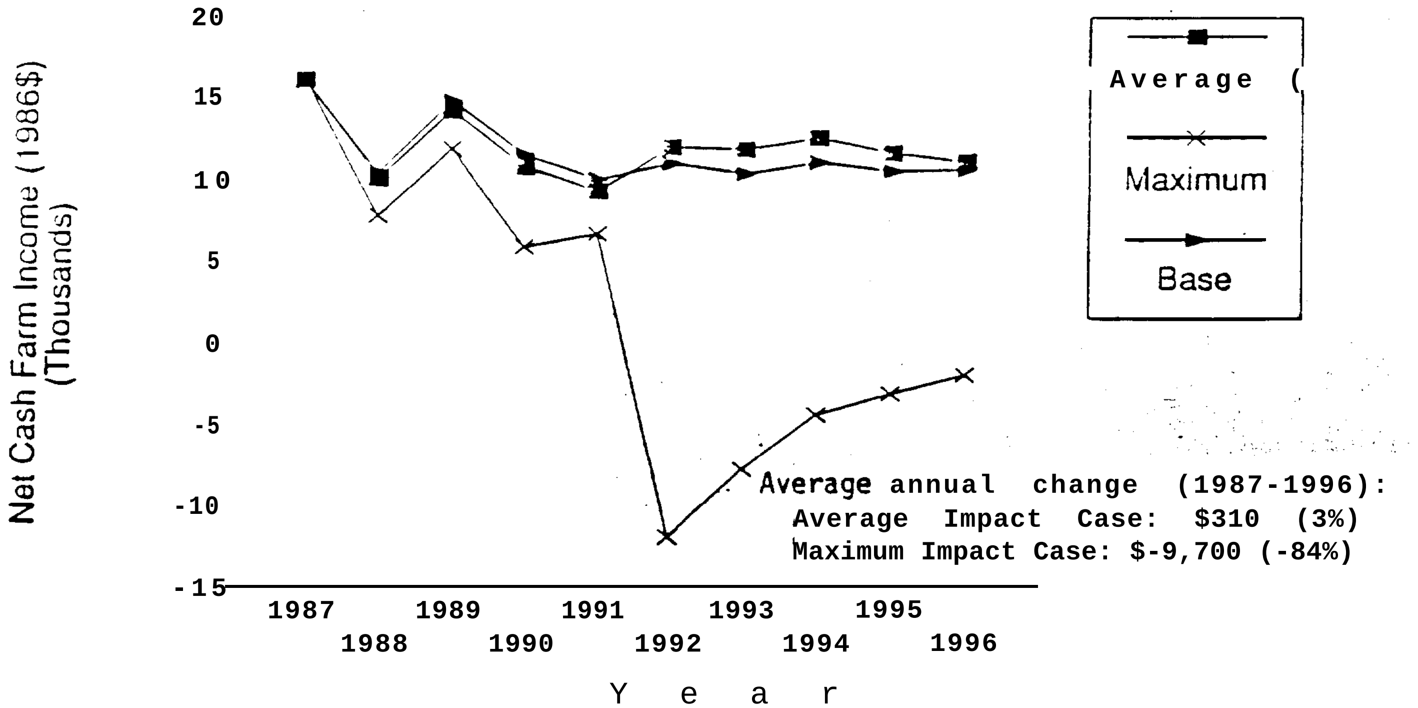


Figure 8. Cumulative probability cost curves for a representative Kansas wheat cattle farm in average financial condition: Scenarios 1 and 3

Kansas Wheat Cattle Farm: Scenario 3

a.



b.

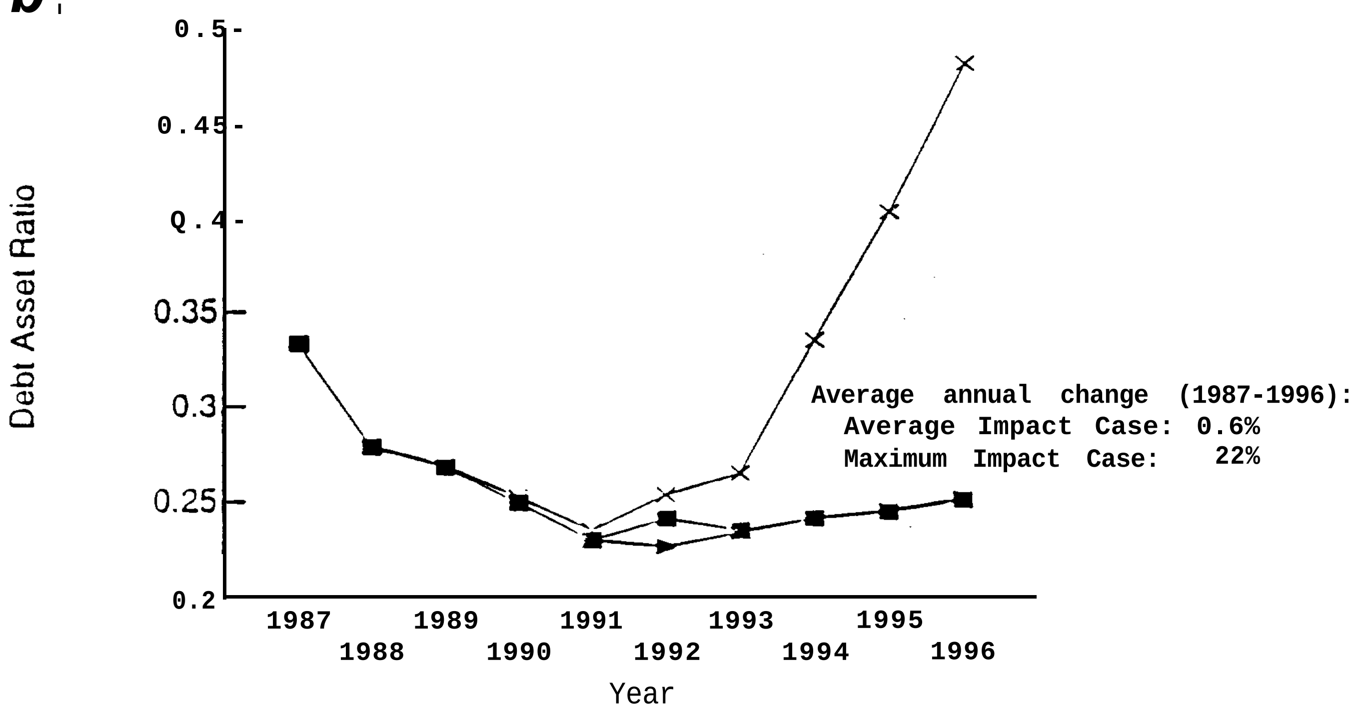


Figure 9. EPA impacts on net cash farm income and **debt asset** ratio for a representative Kansas wheat cattle farm in average financial condition: Scenario 3

seven percent were determined to be in vulnerable financial condition. Survey observations relating to this group of farms were used to develop the characteristics of the Kansas wheat cattle farm in vulnerable financial condition.

In the baseline (no EPA actions) the vulnerable Kansas wheat cattle farm goes out of business in 1993. The decline in net cash farm income experienced by the vulnerable farm under the maximum impact case for Scenario 1 causes it to go out of business one year earlier than in the baseline. The farm does not go out of business earlier than 1993 under any of the other scenarios.

RESULTS OF SPECIALTY CROPS IMPACT ANALYSES

The impact of EPA actions on specialty crop producers was estimated in a two-step process, similar to that used for livestock and major field crops. First, commodity price changes resulting from EPA actions were predicted. Next, the new set of commodity prices, along with the initial cost and yield impacts were used to determine the impacts of EPA actions on the net returns per acre (returns to land and farmer provided labor) of selected producers via income budgeting analyses.

Results of average and maximum impact cases for four of the specialty crops under consideration for Scenarios 1 and 3 are presented below along with a brief introduction of the crop.. Results of the income budgeting analyses for all scenarios are contained in Appendix E along with the initial cost and yield impact estimates.

As this study developed, data deficiencies forced the exclusion of caneberries and peanuts from the analysis. Data which were available are presented in Appendix E along with those of other specialty crops.

Apples

Apple production in the U.S. has approximately doubled since the 1940s. The trend in cultivars has been toward higher quality dessert apples. Current cultivars of major importance are Red Delicious (39 percent), Golden Delicious (17 percent), McIntosh (7 percent), Rome (6 percent), Granny Smith (6 percent), Jonathan (4 percent) and York (4 percent).

Apples are grown widely throughout the U.S., with commercial production in about 35 states. However, the principal states (and their approximate share of total U.S. production) are Washington (36 percent), New York (12 percent) and Michigan (10 percent). Harvested acreage in these states is approximately 161,000, 62,000 and 68,000 acres respectively. According to 1982 estimates, Washington has the largest number of farms with approximately 5,400, followed by Michigan with 2,800 and New York with 2,000.

In recent years apple production has been most profitable in the Washington growing areas where slightly higher yields and higher valued production more than offset higher per acre production costs. Returns have been more modest in New York and Michigan growing areas.

SCENARIO 1

Apple producers in all three study regions (Washington, New York, Michigan) experience similar decreases in net returns per acre under Scenario 1 -- from $2.30 to $6.60 per acre -- but these decreases are higher on a percentage basis in Michigan, because of the state's lower average returns per acre (Figure 10). Decreases in net returns under Scenario 1 are caused by farm worker safety restrictions and restrictions on the use of organophosphates.

SCENARIO 3

Changes in net returns per acre for the average impact case under Scenario 3 differ substantially among production regions (Figure 11). Net returns increased 18 percent in Washington in 1990 while during the same year net returns in New York and Michigan decreased 134 percent and 214 percent respectively. Such dramatic decreases in net returns may bring about substantial structural changes, the discussion of which is beyond the scope of this study. The large differential in net returns among different-regions is due to Proposed restrictions on the use of fungicides in 1990. These restrictions would substantially affect New York and Michigan apple production (e.g., 17 and 12 percent yield reductions) but have no production effect in Washington. 5/ The rise in Washington producers' net returns is due to the 1.8 percent increase in price above the base year caused by the national decline in apple supply.

Potatoes

Potatoes are grown commercially in nearly every state. Total U.S. production ranges from 16 to 20 million tons, depending on the year. Of this production, approximately one-third is used for table stock and one-half for processing. The remainder is used for seed, livestock feed, and export.

While potatoes are grown throughout the U.S., production is concentrated in several areas. The most important area is Southern Idaho, which typically accounts for about 25 percent of total production. South-central Washington is the second largest

5/ The fungicide restrictions considered under Scenario 3 are the cancellation of all EBDCs and chlorothalonil (see Appendix A). See Appendix E, Table E-2 for regional cost and yield impacts.

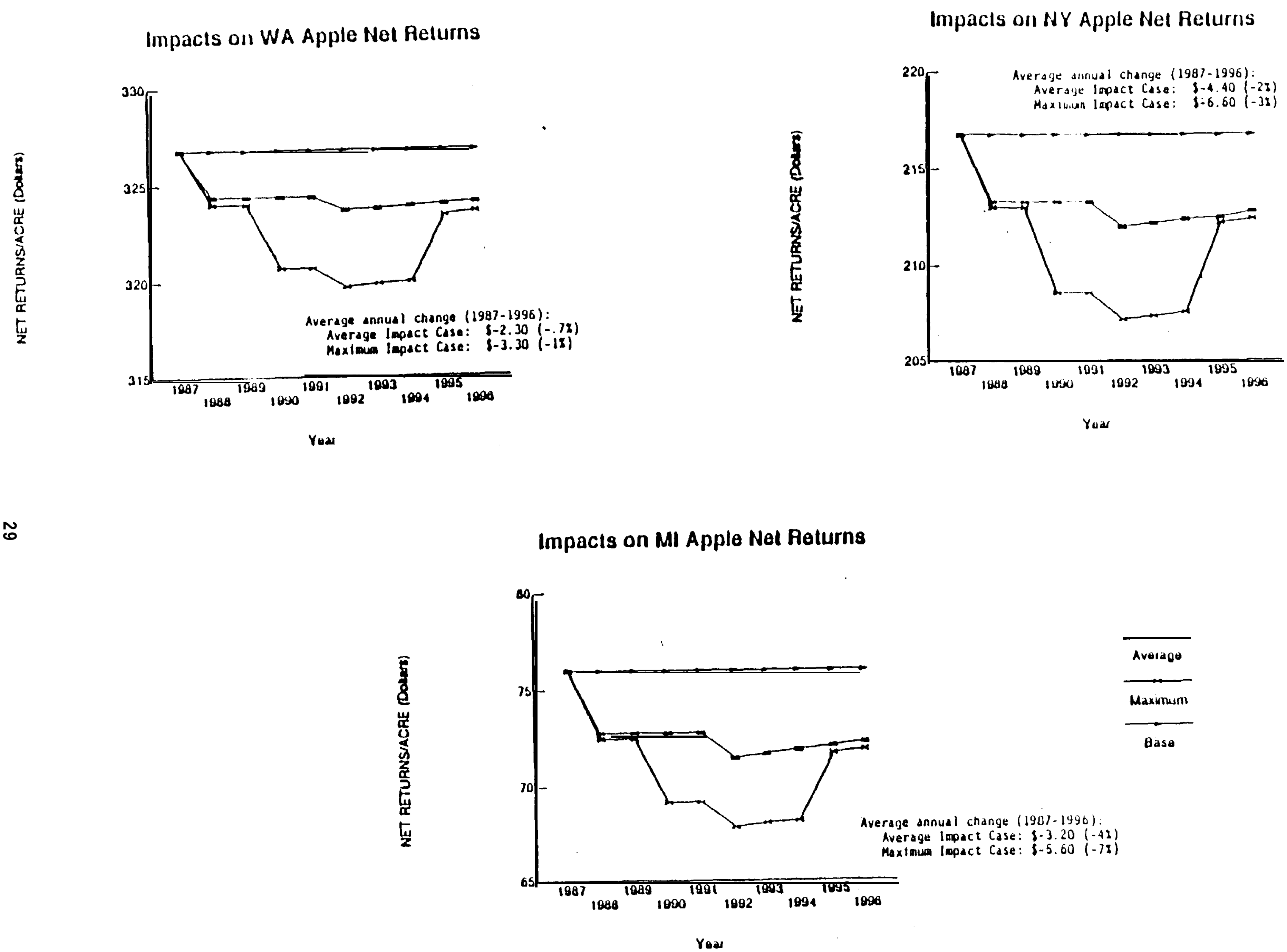
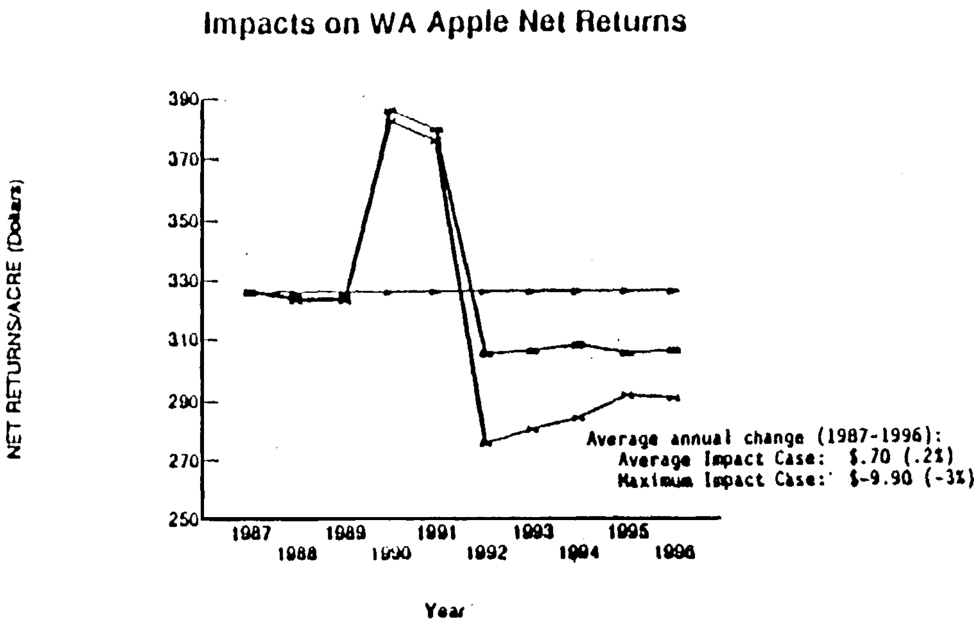
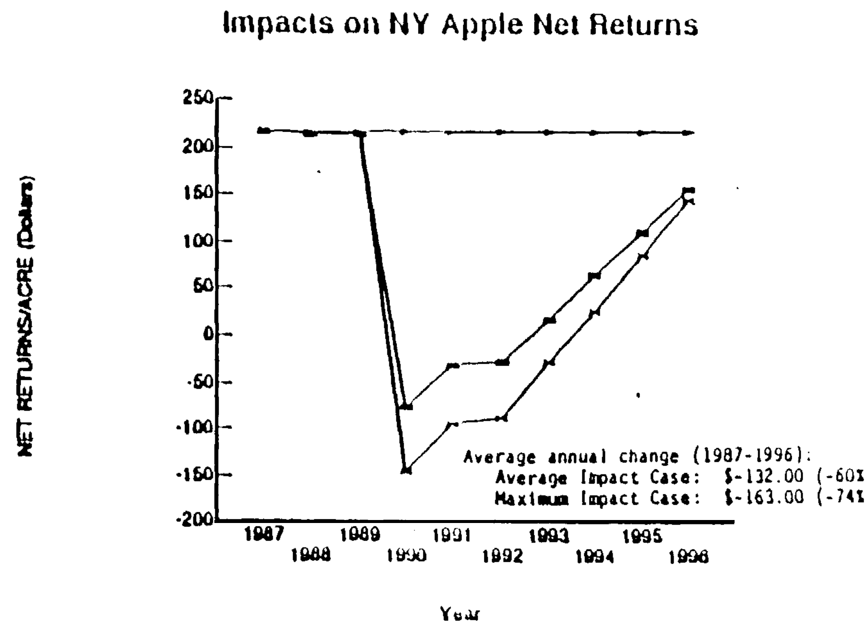


Figure 10. Scenario 1 regulatory impacts on apple production





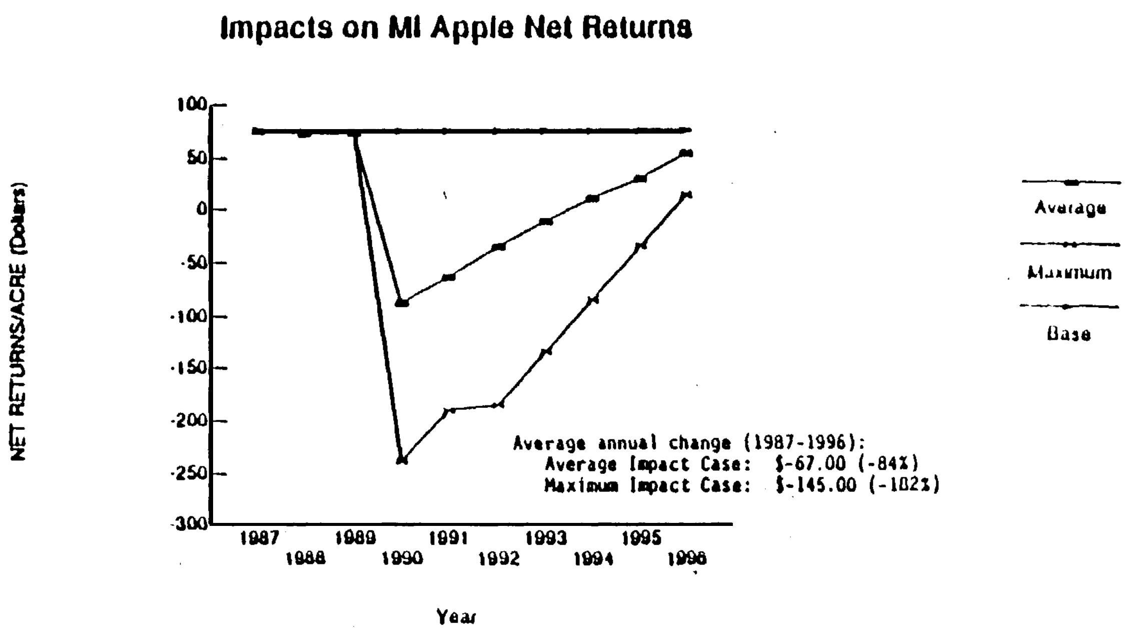


Figure 11. Scenario 3 regulatory impacts on apple production

production area, followed by the Red River Valley of North Dakota and Minnesota, and northern Maine. Together these regions account for up to 60 percent of total U.S. production, with Washington-Idaho harvesting approximately 437,000 acres, North Dakota-Minnesota 194,000 acres, and Maine 98,000 acres. According to 1982 estimates of potato farm numbers, Washington-Idaho has. approximately 2,400, followed by North Dakota-Minnesota with 1,400 and Maine with 1,100.

Cultural practices vary among the major production regions. In Idaho and Washington most of the potato acreage is irrigated and crop yields are among the highest in the country. Acreage in the Red River Valley and Northern Maine is primarily dryland with appreciably lower yields and more modest contributions to farm income from an acre of production.

SCENARIO 1

Net returns per acre in 1987 for the average impact case are slightly lower than the baseline in all regions due to effects of the 1984 cancellation of EDB and the 1987 suspension of dinoseb (Figure 12). In 1990 net returns for Washington-Idaho producers increase above the baseline by .2 percent (average impact case) while net returns for the other regions also increase, but still remain below the baseline. This is explained by the simultaneous increase in the national price (.26 percent above the baseline) and proposed 1990 groundwater regulations which do not affect the Washington-Idaho producers.

In all three production regions the decrease in net returns is substantially larger in the maximum impact case than in the average impact case. Average annual net returns (1987-1996) decreased by .7 percent in Washington-Idaho, four percent-in Minnesota-North Dakota, and 8 percent in Maine under the maximum impact case. Maximum impact estimates are considerably larger than the average for such regulations as the dinoseb cancellation in 1987 and the groundwater regulations in 1990 because only a small percentage of producers are affected.

SCENARIO 3

Results of regulatory impacts on potato producers' net returns per acre are dominated in this scenario by the 1990 proposed restrictions on organophosphate use (Figure 13). Average impact estimates in 1990 include 6.4 and 7.0 percent yield declines in Minnesota-North Dakota and Maine respectively, while the yield decline in Washington-Idaho was estimated at .96 percent (less organophosphates are used in this area). Such a large decline in production results in price increases of 1.8 percent above the base year of 1987 to its highest level during the study period. In Washington-Idaho this increase in price was able to offset the relatively small decline in yield and net returns actually increased above the baseline for the

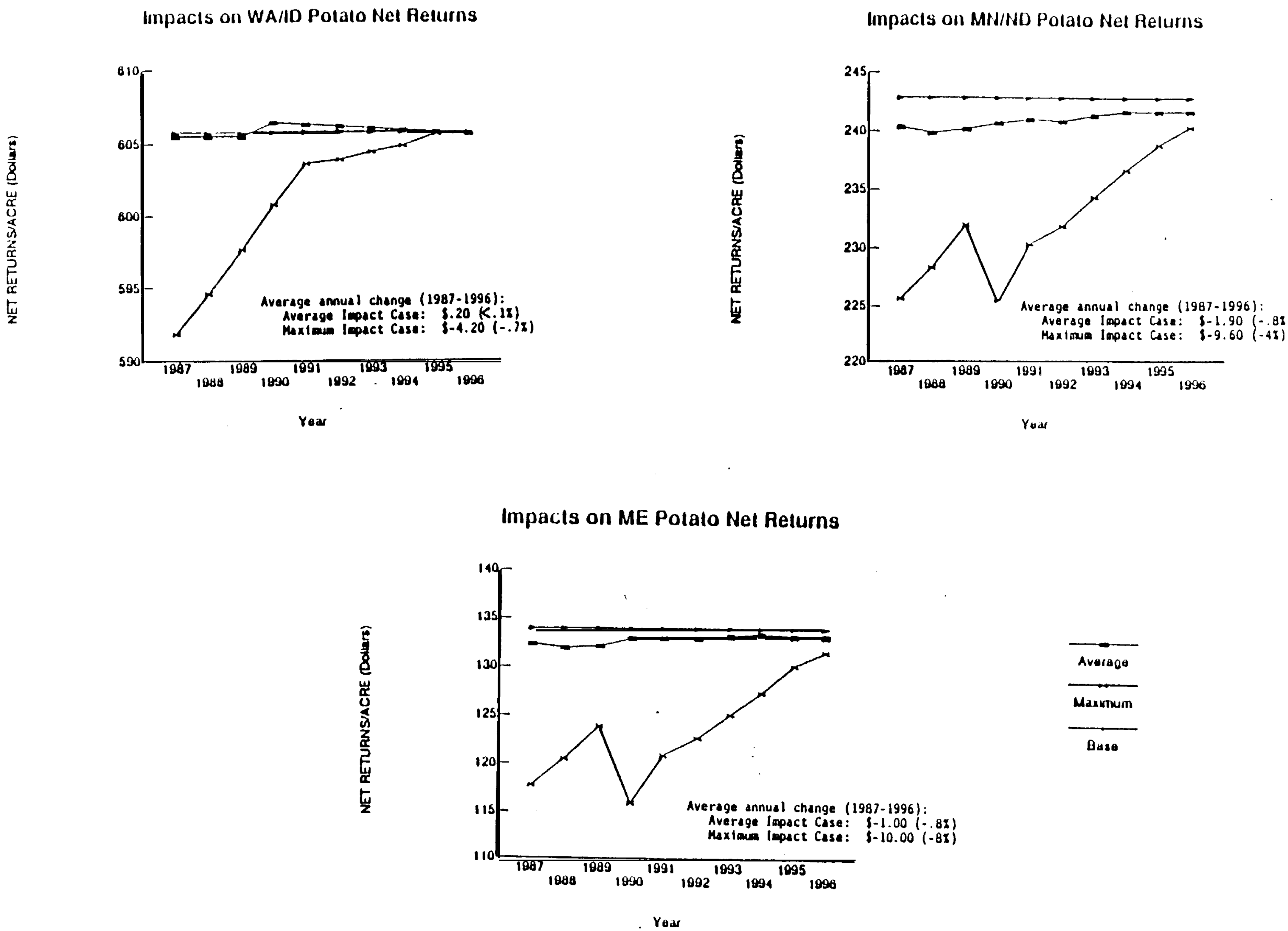


Figure 12. Scenario 1 regulatory impacts on potato production

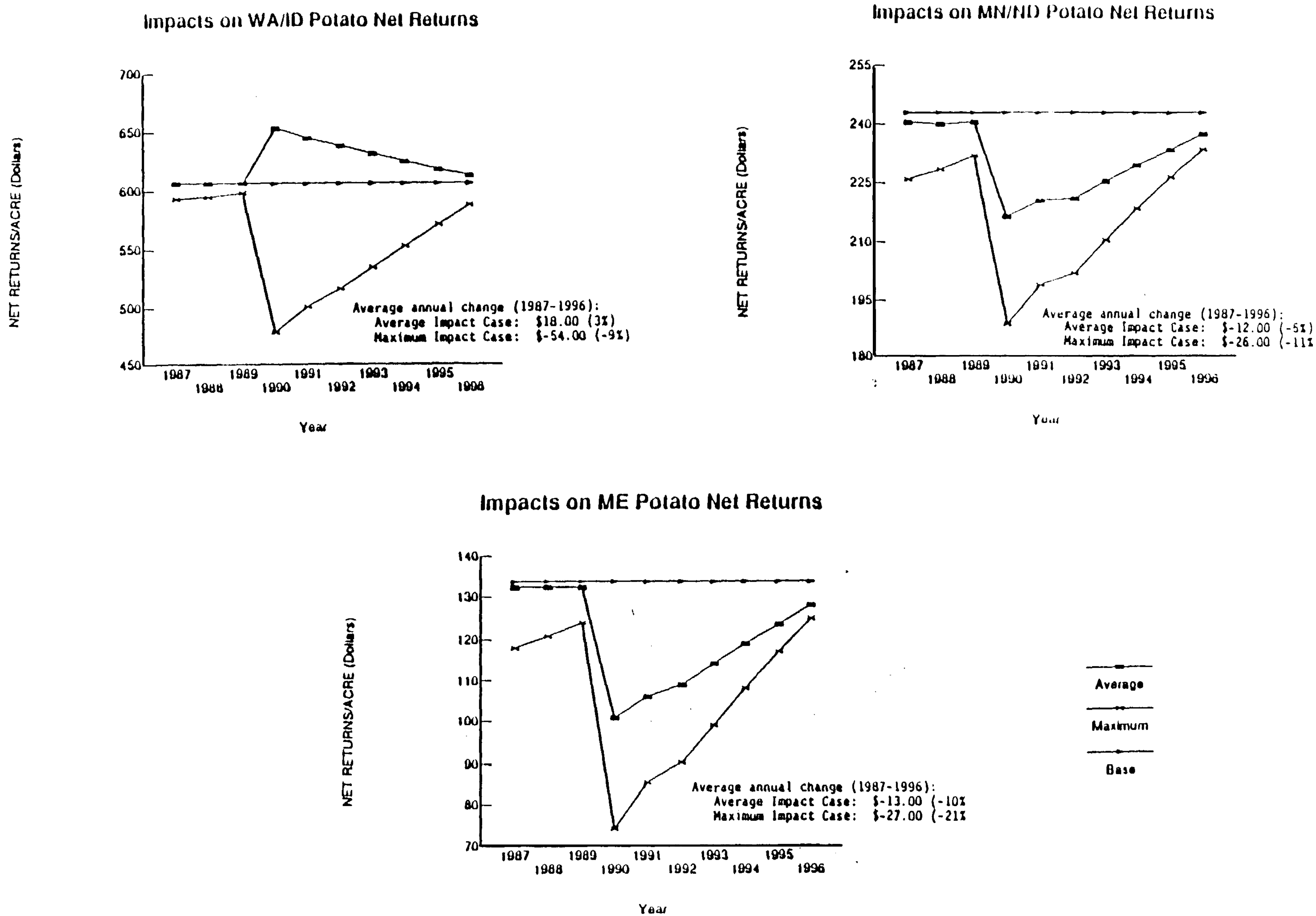


Figure 13. Scenario 3 regulatory impacts on potato production

average impact case. In the other regions, the commodity price increase was modest in relation to the crop yield decreases, and net returns decreased sharply.

Maximum impact results are substantial in all production regions. A yield reduction of eight percent was applied equally in all regions as the result of the proposed 1990 organophosphate restrictions. This reduction in yield when combined with other regulatory actions resulted in an average annual decrease in net returns of nine percent in Washington-Idaho, 11 percent in Minnesota-North Dakota, and 21 percent in Maine during the 1987-1996 period.

Tomatoes

Tomatoes rank second to potatoes in dollar value among all vegetables produced in the U.S. Nearly 85 percent of total production is used for processing, with the remainder utilized fresh.

California is the major tomato growing area, typically accounting for about 75 percent of the total U.S. crop. Ninety to 95 percent of the California crop is used for processing. Florida is the second largest state in terms of production, accounting for six to eight percent of total U.S. production. Unlike 'California, nearly all Florida production is for the fresh market. California harvests approximately 225,000 acres yearly while Florida harvests 45,000 acres. There are approximately 1600 tomato farms in California and 400 in Florida.

The value of tomatoes is much higher for the fresh market, compared to the processing market. Fresh market tomatoes are typically worth approximately $500 per ton at the farm gate, with some variance depending on season, location, and quality. Tomatoes used for processing are typically sold by producers for $70 to $80 per ton.

Yields per acre are also quite different for processed and fresh tomatoes. Tomatoes used for processing are generally direct-seeded (without transplanting) and have relatively higher plant populations per acre. Tomatoes for the fresh market, at least in Florida, are generally transplanted, and the plants are staked; per acre plant populations are much lower.

Net returns per acre of production are considerably higher for fresh tomatoes grown in Florida than for California processing tomatoes. While tomatoes grown in Florida for the fresh market have lower yields and higher growing and harvesting costs, the higher price they command more than offsets these factors. Net returns to management and land are estimated at $1500 per acre compared to $700 per acre for California processing tomatoes.

SCENARIO 1

The impact on net returns per acre from regulatory actions in the tomato producing regions of California and Florida are very similar (Figure 14). The 1988 farm worker safety regulations produce a minimal (less than .3 percent) decline in net returns as measured by average impacts. A more noticeable feature of impacts on tomato producers' net returns is the difference between average and maximum impacts. This difference is explained by the fact that some regulatory actions (e.g., the EDB cancellation which occurred in 1984) have a significant effect on a small number of producers. Under the maximum impact case, the most severe declines in net revenue occur in 1987, with reductions of 1.9 and .8 percent in California and Florida, respectively. Even under the maximum impact cases the decreases in average annual net returns per acre are less than one percent in both Florida and California.

SCENARIO 3

Maximum impacts on yields associated with the proposed 1990 restrictions on fungicides were estimated at 20 percent for both California and Florida. 6/ Such substantial reductions of yield decrease net returns in California by 49 percent and in Florida by 39 percent (Figure 14). Average impacts in California affect net returns less due to a more modest estimate for yield decline of approximately 5 percent.

The impact estimates for tomatoes under Scenario 3 must be viewed with some caution, Yield declines and cost increases were based on information provided by pesticide registrants that has not been thoroughly reviewed by EPA.

Green Peas

Green peas are a relatively minor specialty crop, with production concentrated in the Washington-Oregon and Wisconsin-Minnesota areas. Wisconsin leads all other states in terms of production. Approximately 86,000 acres are harvested yearly in Wisconsin compared to 64,000 acres in Washington. There are approximately 1,700 farms in Wisconsin and 500 in Washington. Yields in Washington average the highest in the nation due. to more capital intensive farming practices such as pivot irrigation. This also accounts for the high cost of production per acre in comparison to other states.

6/ See Appendix E, Table E-5 for the regional cost and yield impacts associated with the fungicide restrictions as well as other actions affecting tomato production.

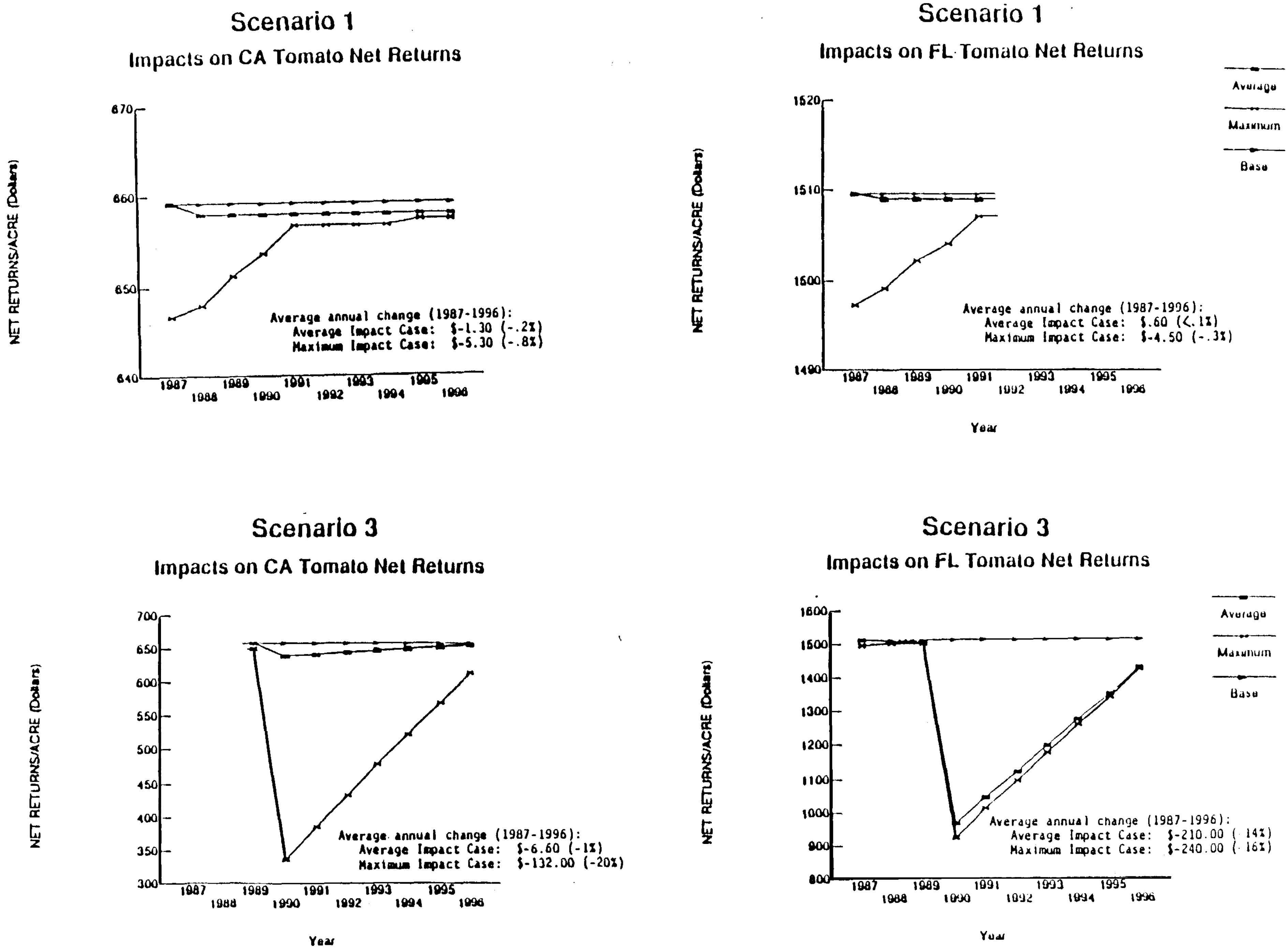


Figure 14. Scenarios 1 and 3 regulatory impacts on tomato production

SCENARIO 1

Average impacts on pea producers' net returns per acre in 1987 result in an initial increase of over one percent in Wisconsin producers' net returns and a corresponding decrease of over seven percent in Washington's net returns (Figure 15). This dichotomy results from the 1987 cancellation of dinoseb which affects only Washington producers. Their response is to decrease production, which results in a commodity price increase of .53 percent over the price in 1986. Wisconsin producers' increase in net returns reflects this price increase. However, the price increase is not enough to offset the costs to Washington producers from the cancellation of dinoseb and their net returns subsequently decline. Additional regulatory impacts (e.g., farm worker safety regulations in 1988 and organophosphate restrictions in 1992) combine with a declining price to decrease net returns in Wisconsin up until 1994.

SCENARIO 3

Regulatory impacts in this scenario are similar to those in Scenario 1 up until 1992 (Figure 15). A noticeable difference occurs in this year when impact estimates of proposed organophosphate restrictions increase sharply over those in Scenario 1. Nevertheless, impacts are still relatively modest even under the maximum impact case when net returns decline 2.0 and 7.8 percent in Wisconsin and Washington, respectively, in 1992, the most severe impact year.

Caneberries

Major caneberry crops include red raspberries, black raspberries, loganberries, boysenberries, and blackberries. Commercial cane-berry crops are grown in the Pacific Northwest, almost exclusively west of the Cascade mountains in the mild marine climates of Oregon, Washington and to a lesser extent in California. Caneberry production has been declining in recent years, due in part to urban expansion in the principal berry regions of Oregon and Washington.

A major problem with the estimation of impacts on caneberries is the lack of information concerning crop production. Very little information is available regarding pesticide use and the efficacy of pesticide alternatives. The cancellation of pesticide registrations can have severe impacts on the industry because of the lack of efficacious alternatives. In general, only a limited number of pesticides are registered for use on caneberries. This is largely' because it is such a minor crop and the cost of registering a pesticide for use outweighs the profits from modest pesticide sales.

Because of the lack of reliable data on caneberry production as well as the caneberry market, impact estimates associated with regulatory scenarios could not be completed.

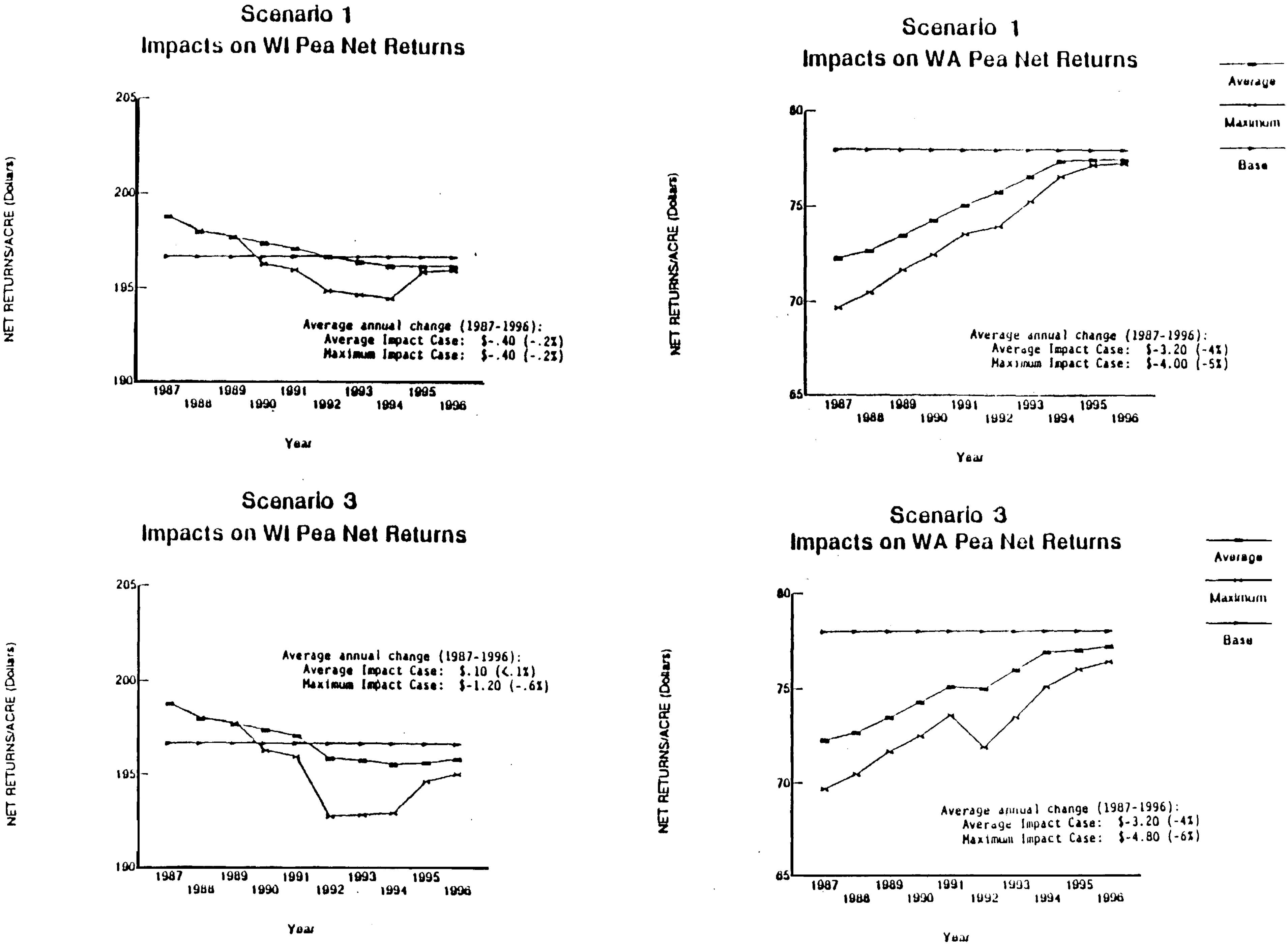


Figure 15. Scenarios 1 and 3 regulatory impacts on peas

Peanuts

The peanut is not actually a nut but rather a legume, more closely related to the pea and bean. The major peanut growing areas, are North Carolina-Virginia, accounting for approximately 15 to 20 percent of total U.S. production, Georgia-Alabama (60 to 65 percent) and Texas-Oklahoma (10 to 15 percent).

Overall profitability of peanut production depends heavily on the U.S. farm program for peanuts. According to the farm program, peanuts are classified as either 'quota' or 'additional', each having a separate pricing system. The price support for quota peanuts is based on the national average cost of production from the previous year, adjusted to reflect any increase in the average cost of production, though restricting annual price increases to 6 percent. Quotas were assigned to farmers on the basis of historical allotments, determined primarily on acreage allotments in place in 1981. (Quotas in 1980 were based on an acreage allotment. Since that time they have been defined based on production, with no regard to acreage.) The quota support price has been $550 per ton since 1983. For purposes of this analysis, quota production was assumed to equal 0.4 million tons at a price of $558 per ton.

Additional or nor-quota peanuts may be grown by anyone. They are used for oil and export (with some buy-back provision if quota production is not adequate to meet domestic edible demand in a given year). The price support for additional peanuts is set to avoid any net cost to the Government, in effect, making the production of additional peanuts- responsive to free-market condition.

Because of unreliable cost and yield estimates associated with various environmental regulations and the lack of critical crop production parameters (e.g., supply elasticities), impact estimates for the regulatory scenarios could not be completed. However, several of the regulatory actions are expected to have significant impacts (over 10 percent decline in yields) on peanut producers including the suspension of toxaphene, the cancellation of certain fungicides and use restrictions stemming from pesticides in groundwater regulations.

SUMMARY AND RECOMMENDATIONS

Summary results for the representative livestock and major field crop farms in average financial condition are presented in Tables 1 and 2. Table 1 indicates the average base net cash farm income for each producer forecasted over the 1987-1996 period and shows the average annual change in income predicted for the same period under Scenarios 1 and 3. Table 2 shows the average base debt to asset ratio and predicted changes for the forecast period. As revealed in these summary results and the preceding report, on average, major field crop and livestock producers are not expected to experience

Table 1. Average Annual Effect of EPA Actions on Net Cash Farm Income (NCFI) 1987-1996 for Farms in Average Financial Condition (1986 $) 1/

	Avg. Base NCFI 1987 - 1996	Scenario 1 Avg. Impact Case	Scenario 1 Max. Impact Case*	Scenario 3 Avg. Impact Case	Scenario 3 Max. Impact Case*
IL Corn Soybean	35,000	-270 (-. 8%)	-2,900 (-8%)	+4,800 (+14%)	-9,200 (-26%)
MS Cotton Soybean	58,900	-1,700 (-3%)	-10,700 (-18%)	-1,300 (-2%)	-14,200 (-24%)
KS Wheat Cattle	11,600	-380 (-3%)	-2,800 (-24%)	+310 (+3%)	-9,700 (-84%)

1/ Average percent changes are indicated In parenthesis.

* All of the representative farms have a 90 percent chance of Incurring coat and yield Impacts that are less than half of those corresponding to the maximum impact case. The maximum impact cases, therefore, must be viewed as very unlikely worst cases.

Table 2. Average Percentage Change In Debt to Asset Ratios (D/A) Caused by EPA Actions (1987-1996) for Farms in Average Financial Condition 1/

	Avg. Base D/A 1987 - 1996	Scenario 1 Avg. Impact Case	Scenario 1 Max. Impact Case*	Scenario 3 Avg. Impact Case	Scenario 3 Max. Impact Case*
IL Corn Soybean	.26	<.1%	1%	-.3%	2%
MS Cotton Soybean	.28	.6%	6%	.5%	6%
KS Wheat Cattle	.26	.3%	3%	.6%	22%

1/ Note that increases In the debt asset ratio (appearing as a positive percentage change In this table) represent a worsening of a farm's financial condition.

l All of the representative farms have a 90 percent chance of incurring cost and yield impacts that are less than half of those corresponding to the maximum impact case. The maximum impact cases, therefore, must be viewed as very unlikely worst cases.

large financial impacts due to EPA actions. For the average impact case, average annual decreases in farm income are three percent or less and the resulting changes in debt to asset ratios are less than one percent. Although the average impact cases indicate that, on average, the losses under these scenarios are minor, the impact on any given producer is a function of both initial financial and production conditions and the extent of the initial cost and yield impacts that are incurred. Large variations in losses incurred by different farmers under any given set of EPA actions are possible.

Maximum impact cases were designed to set an upper bound on the losses that each of the representative farms might incur under each scenario. These cases indicate the income losses that would be incurred if the representative farms were assumed to be impacted by all the EPA actions that could possibly affect them, and represent unlikely worst case scenarios. Even under the extreme maximum impact cases, however, none of the producers in average financial condition go out of business as a result of EPA actions.

Since the ability of farms to withstand losses is a function of their initial financial condition, each scenario of EPA actions was simulated for representative farms in vulnerable financial condition. Although the reductions in net cash farm income were similar for vulnerable farms and farms in average financial condition, these income reductions resulted in larger changes in the debt to asset ratios for vulnerable farms. Only one of the vulnerable farms went out of business any earlier than it otherwise would have due to EPA actions. Under the maximum impact case for Scenario 1, the vulnerable Kansas wheat cattle farm went out of business in 1992, as opposed to in 1993 in the baseline.

Because of limited data availability, the study did not forecast changes in the financial condition of the specialty crop farms. Instead, it examined changes in net returns per acre (which reflect' returns to land and farmer provided labor). Summary results for the specialty crops are provided in Table 3. The base net returns per acre are indicated for each of the crop and regions considered, along with the absolute and percentage changes.

As indicated in Table 3, effects on specialty crop producers are fairly small under Scenario 1. Net returns are reduced by four percent or less under the average impact case, and by eight percent or less under the maximum impact case.

Both average and maximum impact cases result in significant losses for specialty crop producers under Scenario 3. The largest absolute reductions in net returns per acre are incurred by tomato growers in Florida and apple growers in New York and Michigan, with decreases in net returns of $210, $132, and $67, respectively, under the average impact case. These dramatic decreases in net returns may bring about substantial structural changes in the production and markets for the crops affected. Large differences in the impact of EPA regulations on crops grown in different regions occurred-because

Table 3. Average Annual Change in Net Returns Per Acre (NR/A) Caused by EPA Actions 1987-1996 (1986 $)

	Avg. Base NR/A 1987 - 1996 1/	Scenario 1 Avg. Impact Case	Scenario 1 Max. Impact Case	Scenario 3 Avg. Impact Case	Scenario 3 Max. Impact Case
Apples					
WA	330	-2.30 (-0.7%)	-3.30 (-1%)	+0.70 (0.2%)	-9.90 (-3%)
NY	220	-4.40 (-2%)	-6.60 (-3%)	-132.00 (-60%)	-163.00 (-74%)
MI	80	-3.20 (-4%)	-5.60 (-7%)	-67.00 (-84%)	-145.00 (-182%)
Potatoes					
WA/ID	600	+.20 (<0.1%)	-4.20 (-0.7%)	+18.00 (3%)	-54.00 (-9%)
MN/ND	240	-1.90 (-0.8%)	-9.60 (-4%)	-12.00 (-5%)	-26.00 (-11%)
ME	130	-1.00 (-0.8%)	-10.00 (-8%)	-13.00 (-10%)	-27.00 (-21%)
Tomatoes					
CA	660	-1.30 (-0.2%)	-5.30 (-0.8%)	-6.60 (-1%)	-132.00 (-20%)
FL	1,500	+.60 (<0.1%)	-4.50 (-0.3%)	-210.00 (-1.4%)	-240.00 (-16%)
Peas					
WI	200	-.40 (-0.2%)	-.40 (-0.2%)	+.1O (<0.1%)	-1.20 (-0.6%)
WA	80	-3.20 (-4%)	-4.00 (-5%)	-3.20 (-4%)	-4.80 (-6%)

1/ Net returns per acre are based on regional budget information, and are assumed constant over the period 1987-1996 in the base case, and are in 1986 dollars.

some of the proposed restrictions involve pesticides that are used in some regions and not in others. Even though the results of this study must be considered preliminary, these figures show that EPA actions could create economic problems for some specialty crop farms and suggest that the-Agency exercise considerable caution in this area.

Impacts on potato producers under Scenario 3 are significant, although the absolute decreases are relatively small (approximately $26 in each region) these decreases result in an 11 percent and a 21 percent reduction in net returns per acre in Minnesota/North Dakota and Maine, respectively.

Impacts on pea producers are relatively modest. Even under the maximum impact cases for the most expansive EPA scenario, net returns per acre are decreased by less than $5.00 in both of the regions that were examined.

This study illustrates the advantages of examining the impacts of environmental regulations at the farm level as well as at the aggregate national level. While national analyses provide useful information concerning the total losses incurred by different aggregate types of farmers (e.g., corn farmers as a whole), the impact of environmental regulations on farms' financial conditions depends on the distribution of those losses among farmers and on the initial financial conditions of the affected farms. In order to determine the effect of EPA regulations on the ability of farms to survive, both aggregate and farm level analyses are necessary.

This study highlights the data and analytical requirements necessary to determine the impacts of EPA actions on agriculture. Such requirements include:

1. Accurate pesticide usage data,

2. Accurate pesticide efficacy data,

3. Improved information on how initial pesticide cancellation effects change over time,

4. Accurate incidence data for non-pesticide related impacts (e.g., underground storage tanks),

5. Improved national price-quantity models to predict commodity price changes due to EPA actions, and

6. Better information on the initial financial and production conditions of agricultural producers and farm level models for estimating changes in these over time.

The need for better data and modeling capability is greatest for specialty crops, where reliable pesticide usage and efficacy data, often do not exist, limited information is available on producers' initial financial condition, and few models are available. EPA is currently compiling a directory of all specialty crop models. Improvements in pesticide usage data might be obtained by increased cooperation and cost sharing with USDA and states to fund additional pesticide usage surveys or to add pesticide usage questions to surveys designed for. other purposes. In addition, registrants of pesticides might be required to provide usage information. Appendix H provides a discussion of additional options that might be considered for improving the data available to complete studies of this type. Reliable pesticide usage data, efficacy data, national price-quantity models, and farm level models are likely to become increasingly important in the future, as EPA tries to reduce environmental risks associated with agricultural production in a cost-effective manner.